

AD-A146 090

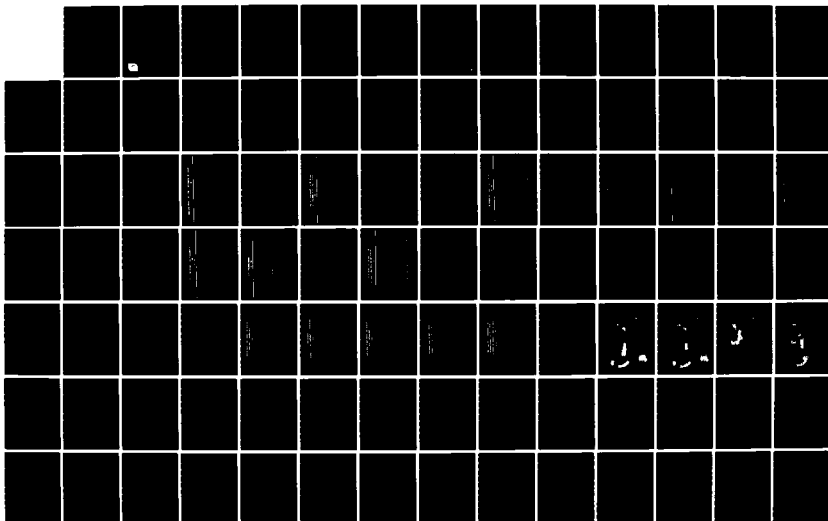
EVALUATION OF THE DEIMS (DEFENSE ECONOMIC IMPACT  
MODELING SYSTEM) SYSTEM(U) INSTITUTE FOR DEFENSE  
ANALYSES ALEXANDRIA VA R W THOMAS JUL 84 IDA-D-67  
IDA/HQ-84-28880 MDA903-84-C-0031

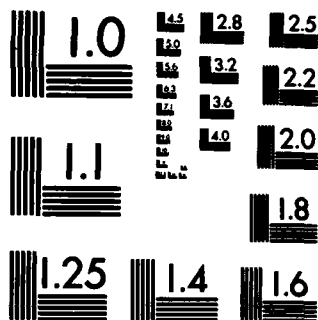
1/2

UNCLASSIFIED

F/G 5/3

NL





2

IDA RECORD DOCUMENT D-67

## EVALUATION OF THE DEIMS SYSTEM

R. William Thomas

July 1984

*Prepared for*

Office of the Secretary of Defense  
Assistant Secretary (Manpower Installations & Logistics)  
and

Office of the Secretary of Defense  
Director, Program Analysis and Evaluation

This document has been approved  
for public release and sale; its  
distribution is unlimited.

DTIC  
ELECTRONIC  
OCT 1 1984



INSTITUTE FOR DEFENSE ANALYSES

AD-A146 090

DTIC FILE COPY

84 09 26 147

IDA Log No. HQ 84-28880

**The work reported in this document was conducted under Contract MDA-903-84-C-0031 for the Department of Defense. The publication of this IDA Record Document does not indicate endorsement by the Department of Defense, nor should the contents be construed as reflecting the official position of that agency.**

**Approved for public release; distribution unlimited.**

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. ADA146090	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle)  Evaluation of the DEIMS System		5. TYPE OF REPORT & PERIOD COVERED  Final
7. AUTHOR(s)  R. William Thomas		6. PERFORMING ORG. REPORT NUMBER IDA Record Document D-67
9. PERFORMING ORGANIZATION NAME AND ADDRESS Institute for Defense Analyses 1801 N. Beauregard Street Alexandria, VA 22311		8. CONTRACT OR GRANT NUMBER(s)  MDA 903 84 C 0031
11. CONTROLLING OFFICE NAME AND ADDRESS OSD (ODPA&E) and ASD (MI&L) The Pentagon Washington, D.C. 20301		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS  Task T-4-241
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) OUSDRE (DoD-IDA Management Office) 1801 N. Beauregard Street Alexandria, VA 22311		12. REPORT DATE July 1984
		13. NUMBER OF PAGES 107
		15. SECURITY CLASS. (of this report)  UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A
16. DISTRIBUTION STATEMENT (of this Report)  Approved for public release: distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)  Input/Output Modeling Defense Spending Economic Analysis Defense Budget		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  This document is a summary of the proceedings of a conference held on May 8, 1984. The purpose of the conference was to present the results of the Defense Economic Impact Modeling System (DEIMS) forecasts of the impact of the Five Year Defense Program for 1985-89 and to solicit public comment and expert appraisal of the system and results.		

DD FORM 1473

EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

IDA RECORD DOCUMENT D-67

## EVALUATION OF THE DEIMS SYSTEM

R. William Thomas

July 1984.



A-1



INSTITUTE FOR DEFENSE ANALYSES  
1801 N. Beauregard Street, Alexandria, Virginia 22311

Contract MDA 903 84 C 0031  
Task T-4-241

## PREFACE

This document is a summary of the proceedings of a conference held on May 8, 1984. The purpose of the conference was to present the results of the Defense Economic Impact Modeling System (DEIMS) forecasts of the impact of the Five Year Defense Program for 1985-89 and to solicit public comment and expert appraisal of the system and results.

This summary was prepared under Task T-4-241 for the Office of Economic Adjustment, Office of the Secretary of Defense.

## TABLE OF CONTENTS

Preface	1
Conference Program	iii
1. General Comments on the System	2
2. Comments Regarding the Translator	3
3. Input/output Modeling Procedures in DEIMS	6
4. Labor and Materials Forecasts with DEIMS	7
5. Regional Forecasting System	8
6. Model Verification and Validation	11
7. Use of the System for Policy Analyses	12
8. Priorities for DEIMS Improvements	13

### Appendices

Appendix A -- Program Participants and Attendees	
Appendix B -- Remarks of Assistant Secretary of Defense Lawrence J. Korb	
Appendix C -- Briefing Charts for the DEIMS Forecast Presentations	
Appendix D -- Remarks of Dr. David S.C. Chu, Director, Program Analysis and Evaluation	
Appendix E -- Speech of Deputy Secretary of Defense William H. Taft IV	
Appendix F -- Written Remarks Submitted by Panelists	



May 8, 1984  
FORECASTING THE IMPACT OF DEFENSE SPENDING  
CONFERENCE SCHEDULE

8:00 am Registration (coffee and danish)

8:45 WELCOME - Gen. Andrew J. Goodpaster, President, IDA  
SESSION I - THE 1985 DEFENSE BUDGET - (Renoir Suite)

9:00 Introduction - Dr. David Chu, Director, PA&E  
Speaker - Dr. Lawrence Korb, Assistant Secretary  
of Defense for Manpower, Installations,  
and Logistics

9:45 Break

SESSION II - THE STRUCTURE OF DEFENSE DEMAND

10:00 Introduction - Dr. David L. McNicol, Director Economic  
Analysis, PA&E  
Industrial Demand - Dr. David Blond  
Regional Distribution of Defense Spending - Mr. Paul Dickens, PA&E  
Labor Demand - Dr. David Blond  
Conclusion - Dr. David L. McNicol

11:00 Break

SESSION III - IMPACT OF DEFENSE SPENDING ON THE ECONOMY

11:15 Introduction - Dr. Robert F. Hale, Asst. Director, National  
Security and Inter. Affairs, CBO  
Panelists: Dr. David Chu, Director, PA&E  
Dr. George R. Brown, Vice President, DRI

12:30 Luncheon - (Renoir Suite)  
Luncheon Speaker: Mr. William H. Taft IV, Deputy Secretary of Defense  
Topic: "ECONOMIC EFFECTS OF DEFENSE SPENDING"

FORECASTING THE IMPACT OF DEFENSE SPENDING  
CONFERENCE SCHEDULE

2:00 pm CONCURRENT SESSIONS -

SESSION IV - GNP AND INDUSTRIAL DEMAND FORECASTS - (Renoir I Suite)

Moderator: Dr. William Cox, Senior Specialist for Economic  
Policy, Congressional Research Service

Panelists: Mr. David K. Henry, U.S. Dept. of Commerce  
Dr. George R. Schink, Vice-President, Wharton EFA, Inc.  
Dr. Lawrence R. Forest, Congressional Budget Office

SESSION V - LABOR AND MATERIAL FORECASTS - (Monet I Suite)

Moderator: Mr. Robert L. Terrell, Professional Staff, Committee on Energy  
and National Resources, U.S. Senate

Panelists: Mr. Ronald Kutscher, Associate Commissioner, Bureau of Labor  
Statistics  
Dr. John Morgan, U.S. Bureau of Mines  
Mr. Alan Fechter, National Academy of Sciences

SESSION VI - REGIONAL IMPACT FORECAST - (Renoir II Suite)

Moderator: Dr. Robert Rauner, Director, Office of Economic Adjustment, OSD

Panelists: Dr. Douglas Brown, Georgetown University  
Mr. Joseph Cartwright, U.S. Department of Commerce  
Dr. Karen Polenske, Mass. Inst. of Technology.

## EVALUATION OF THE DEIMS SYSTEM

### CONFERENCE SUMMARY

This memorandum is a summary of the proceedings of a conference held on May 8, 1984 in Washington, D.C. The conference was sponsored by the Institute for Defense Analyses (IDA), with financial support from the Office of Economic Adjustment and the Office of the Director, Program Analysis and Evaluation, Office of the Secretary of Defense. The purpose of the conference was to present the results of the Defense Economic Impact Modeling System forecasts for the 1985-1989 Defense Program and to solicit public comment and expert appraisal of the system and results.

Materials related to the conference appear at Tabs A-F to this memorandum. These include a list of participants and presentations and comments by the participants.

General Andrew J. Goodpaster extended a welcome to participants and explained the purposes of the conference. Dr. Lawrence J. Korb then presented an analysis of historic trends in the various elements of the Department of Defense Budget and related these to the President's Defense Program for 1985-89 (Appendix B). His presentation illustrated the difficulty of making cuts in near-term outlays for Defense without adversely impacting military capability.

In the second session, Dr. David L. McNicol reviewed the purposes for which DEIMS was created and how it is used within and outside DoD. Dr. David L. Blond then presented highlights of the industrial and labor impact of defense spending during 1985-89. Mr. Paul Dickens then analysed trends in the

regional distribution of defense spending and their implications for the various regions of the nation. Highlights of these presentations are in Appendix C.

The third session dealt with major issues related to the impact of defense spending on the economy. The speakers were invited to range broadly over this topic, and not to confine themselves to DEIMS. Drs. Chu and Brown and Mr. Hale suggested a number of important analytic issues, including:

- how to introduce greater competition for defense business;
- adequacy of the defense industrial base;
- sharing the "burden" and "benefit" of defense research and production with our allies;
- warranties for defense goods; and
- impact of economic trends on the defense program.

A summary of Dr. Chu's remarks appears in Appendix D.

In the afternoon sessions, outside experts were invited to comment on DEIMS methodology and forecasting results. The remainder of this paper is devoted to a summary of their criticisms and recommendations.

#### 1. General Comments on the System

Ronald Kutscher stated that the Defense Economic Impact Modeling System (DEIMS) is a good start toward improved estimation of the impacts of Defense spending on the economy. Its positive features include the use of input/output modeling to capture the indirect effects of defense spending, a detailed breakout of defense purchases by budget account and supplying industry, and forecasts of employment, occupational demand, and materials usage.

George Schink agreed that DEIMS is a good start in attempting to provide a detailed microeconomic understanding of the effects of defense spending.

However, it was pointed out by Lawrence Forest and David Henry that DEIMS neglects the supply side of the economy. There are no estimates of capacity to compare to the demand estimates generated by the system.

General approval was expressed for the new documentation materials prepared for DEIMS.

Henry suggested that if the DEIMS model is to generate official DoD estimates, other DoD offices, particularly the Comptroller and Office of Industrial Resources, should participate in validating and sanctioning the DEIMS results. He also cautioned that security precautions to protect the classified nature of the source data in the FYDP and other budget documents need to be addressed. Determination should be made as to what point in the calculations the data are declassified by appropriate security officials in DoD.

## 2. Comments regarding the Translator

The Defense Translator is a critical element in the DEIMS system. It represents the link between the Defense Budget and estimates of goods and services supplied to DoD by the 400 input/output industries. Comments were directed to the logic of the translator, to the data sources used in its construction, and to its documentation.

Logic of the translator -- Henry pointed out that DEIMS estimates of defense spending include only DoD spending, and not spending by other agencies of the Federal Government for national defense (chiefly spending by the Department of Energy for the nuclear weapons program). This means that DEIMS's total spending is also not consistent with the National Accounts

definition of defense spending used in the DRI macroeconomic model and the input/output model.

Henry also argued that the process of unbundling major weapon systems into a first order bill of goods is a good way to implicitly revise input/output coefficients to reflect military specific technology in interindustry transactions. However, unless compensatory adjustments are made, the output of the industry producing the major weapon system will be understated, and the outputs of the industries supplying first round inputs to the system will be overstated.

Henry went on to say that DEIMS estimates investment outlays to facilitate the production of new major weapons systems by distributing a portion of the buy to capital equipment, particularly metalworking machinery. This method results in double counting investment requirements unless the fixed private business investment component of nondefense final demand is reduced to compensate. The procedures used to estimate and include trade and transportation margins are crude and introduce error into the overall translator.

Joseph Cartwright was troubled by inconsistencies between the national and regional DEIMS procedures. In particular, national DEIMS excludes from measurement the consumption and investment effects associated with either military or civilian defense pay, but the latter are included in the regional defense estimates.

While he recognized that the translator surely could be improved in many details and needs regular updating, Forest did not believe that much additional effort on refining the translator would improve DEIMS markedly. Efforts should be directed elsewhere in the system. By contrast, Cartwright would like to see major weapon systems reflected individually, rather than by classes of equipment, in the procurement accounts.

Data Sources and Reliability -- Kutscher pointed out that in many cases, the translator has been constructed by substituting judgment where data are unavailable or inadequately detailed. The use of judgment, especially when it is based on other data or analyses, is not bad in itself; however, if outside observers cannot distinguish which elements of the system are based on hard data and which on judgment, the credibility of the entire system is damaged.

In those cases where data have been available to better identify the component elements of major weapon system purchases (such as aircraft), Henry remarked that considerable revisions were required to capture more accurately the specific impact of defense purchases. What does this say about the reliability of other parts of the translator, constructed by cruder methods, for which similar data are unavailable?

Questions were raised from the audience regarding the accuracy of the translator and the frequency with which it is updated. Henry noted that the Operation and Maintenance accounts need updating especially, since only Fiscal Year 1981 data were used in their initial estimation. That year may not be representative of current conditions. The procurement translator vectors are probably much better than the O&M ones, since they have been scrutinized and revised extensively annually. The vectors for the military construction accounts also have not been updated, but they may be more stable than the O&M or procurement vectors.

Translator documentation -- Several favorable and no unfavorable comments were made regarding the documentation of the defense translator. Forest noted that this is the only case he could remember in which the numbers don't come out of an inaccessible black box. Cartwright thought the overall discussion of the translator in Chapter II was "particularly clear". Douglas Brown described the documentation of DEIMS as excellent.

### 3. Input/output Modeling Procedures in DEIMS

Discussion of the input/output modeling procedure concentrated on the use of adjustments to the translator to seek to reflect the special composition of DoD weapon systems, rather than developing special input/output vectors for these systems. (Note: the paper, "Properties of the DEIMS Translator" which describes these adjustments was not completed at the time of the conference and was not available to the panelists.)

Henry agreed that unbundling major weapon systems into a first order bill of goods is a satisfactory way to implicitly revise the input/output coefficients to reflect military specific or current technology in inter-industry transactions. However, unless compensatory adjustments are made, the output of the industry producing the major weapon system can be understated. Also, first order inputs are final demands in the DEIMS system. Output of these first order inputs are also generated indirectly by the final sales of the weapon system. Unless it is done carefully, the procedure would tend to overestimate outputs of these supplier industries.

A comparison by Henry of the DEIMS output and Census data (Cf. his letter at Tab E) showed that DEIMS underestimated shipments of aircraft (SIC 3721) by 16 percent and overestimated engine (SIC 3724,3764) and aircraft equipment (SIC 3728,3769) shipments by seven and 29 percent, respectively. (Note: Henry did not state on which DEIMS forecast this comparison was based. It is believed that it represents an earlier version of the translator, before compensatory adjustments were introduced.)

A second point made by Henry is that additional effort should be spent on validating the translator results by comparing them with Census shipments data. (Note: I believe that such comparisons have been done, but the results have not been documented.)



One aspect of the unbundling procedure is the estimation of investment outlays for certain items of capital equipment, particularly metalworking machinery. Therefore, these investments are included in Federal Government purchases of goods and services. This method doublecounts investment outlays unless a compensatory adjustment is made to the private business investment component of final demand. Also, Henry notes, a better distribution is needed for structures versus equipment.

#### 4. Labor and Material Forecasts with DEIMS

John Morgan noted that the materials forecasting system was driven off the results of the input/output modeling system. This raises the question of how relevant 1972 input/output relationships are to 1985 defense production. His general appraisal of the reliability of the system was that it would tend to produce acceptably reliable estimates for old materials (steel, aluminum, etc.) but that new, high-technology materials such as glass fiber, cobalt, titanium, and semiconductor materials would not be adequately captured in the system.

Kutscher discussed the labor requirements and occupational demand forecasts of the DEIMS system. He noted that the data on occupation distributions were the product of his organization, the Bureau of Labor Statistics, and the modeling steps followed were similar to those used by BLS in their employment and output analyses. Hence, he could not criticize the methodology per se. However, at BLS the results are subjected to critical appraisal, assumptions modified and models rerun several times before any analyses are publicly released. It is this process which is missing in the DEIMS procedures.

Kutscher suggested that research be performed to address some of the data deficiencies common to DEIMS and other systems designed to perform economic analyses of defense. This research would address topics such as the relationship between production

and employment growth, the specialized occupational requirements of defense production and how they differ from civilian production and the incorporation of technological change into the input/output relationships.

Alan Fechter noted that occupational demands are determined solely by the industry supplying the product, and not by the type of defense spending which generated it. Given the large element of Research and Development (R&D) spending by DoD, the use of occupational distributions estimated based on the entire industry, and not the firms supplying DoD, may understate the demand for the scarce scientific and technical personnel employed in Defense R&D. He suggested that additional studies be done to seek better estimates of the latter for use in the occupational model.

Fechter was concerned that DEIMS results contain only demands for labor, and not estimates of supplies. Policymakers need both in order to identify bottlenecks in labor markets. The National Science Foundation has developed supply models for certain scientific, technical, and engineering personnel; these models could be incorporated into DEIMS to improve the usefulness of the information.

##### 5. Regional Forecasting System

The regional forecasting system of DEIMS develops estimates of the income generated in each of the fifty states and the District of Columbia due to defense spending. An important innovation of the system is the ability to relate income to Department of Defense budget categories. The system also calculates the employment impact of DoD spending by state and major industry.

Cartwright called attention to the procedures used by DEIMS to regionalize the national results. Direct impacts are based on 1979-81 historical patterns of the distribution of

defense spending, based on administrative records. Indirect impacts by industry are estimated in two steps: first, national indirect impacts are estimated as the difference between national total impacts and the total of the regional direct impacts. Second, these indirect estimates are distributed to the states based on historical data on the distribution of firms in the industry among the states. A purer approach is to distribute direct impact (step 1 above) and then to calculate indirect state impacts using regional input/output models.

Other potential problems noted by Cartwright are the following:

(a) Direct impacts are estimated by prime contract award data. The data referred to include Government furnished equipment produced in the private sector. This raises two questions: (i) are direct and indirect impacts defined consistently in the national and regional DEIMS system? and (ii) if not, what difference does it make to the results?

(b) For contract awards the address of record may not be the place of performance, especially when a major portion of the prime contract award is "subcontracted".

(c) The 14 categories of awards available in the data may not be disaggregated enough for regional analysis.

Cartwright went on to say that the "sharing-out" procedure used for the indirect impacts is not an accurate technique. Many of the indirect impacts necessarily occur in the same state as (or neighboring states to) the location of the direct outlays. Examples include most services, construction, as well as certain types of goods. The impact of the DEIMS procedures is to to equalize the distribution among states, relative to the actual pattern.

Brown expressed general appreciation for the work done to date in the regional area. His comments were directed toward

problems with the current version of the model and recommendations for future research. He was troubled by the fact that state shares (of defense activity) are essentially exogenous to the state. This is the same point raised by Cartwright; that there is no direct (intrastate) linkage between direct impacts and indirect impacts.

Brown suggested that DoD investigate whether the initial allocation by state(s) of prime contract performance could be done on a weapon specific basis. One verification procedure would be to concentrate on key sectors in states with major defense activity (i.e., California, Texas, New York, Florida, Connecticut) and make independent forecasts using the primary data and an independent methodology, such as an economic base multiplier.

Brown calculated the state level multipliers for a few states by taking the ratio of direct and indirect spending to direct spending. Typically, regional multipliers at the state level are smaller than national multipliers, around 1.5 rather than 2.5. This is because the leakage (into other states) is so much greater at the regional level. His analyses showed very high multipliers (3.5 - 4.0) for Illinois and Michigan, while California and Texas had more normal values. These results suggest that the sharing procedure may in fact overstate the indirect effects for less defense intensive states and understate them for the more intensive states, as Cartwright suggested.

Karen Polenske stated that she agreed with most of the points discussed by the other panelists, and would not bother repeating them. She emphasized that the methodology must be evaluated in terms of (i) the objectives of the system and (ii) the resources available to support the effort. Clearly, a superior methodology (using regional input/output tables to relate state direct and indirect effects) is available, but

at a much higher cost. The current procedure will give reasonable results under the following conditions: (i) regional technologies are similar and (ii) the distribution of direct defense spending is relatively even across states (on a per capita basis). If either of these conditions is violated, the top down shift-share methodology is inferior to a bottom up methodology.

Polenske went on to say that regional input/output data are not collected regularly by official agencies of the Federal Government. Consequently, analysts are forced to use shift-share and gravity models for regional analyses, unless they want to support an extensive and expensive regional data collection procedure.

Gaps exist in the documentation, Polenske commented. More emphasis should be placed on documenting the system. Fully one-half the effort needs to be spent on documentation, if the models are going to be used.

#### 6. Model Validation and Verification

Polenske then addressed the verification issue. Are results such as these even subject to verification? Since the primary data are often unavailable to compare with the model results, she suggested using industry and state economic experts as a technical review panel for the results. Consistency checks can also be used to assure that the model's results are internally consistent; these, of course, do not assure that the results are reasonable.

Given the large number of assumptions and exogenous variables in the model, a comprehensive sensitivity analysis would be hopelessly complex. Alan Fechter suggested an innovative approach to sensitivity analyses, which he had seen used in other work. The distributions or range of variation for important assumptions could be characterized and random samples

drawn from these distributions to determine the set of sensitivity analyses to be performed. In this way, the number of alternative scenarios can be held to reasonable limits, while the selection of these cases is not subject to the (perhaps inadvertent) biases of the model developer.

A different approach was suggested by Schink. He urged that additional scenarios be analysed through DEIMS. These could be chosen from the competing proposals for Defense spending offered by the political opposition or private individuals or groups. DEIMS should be made generally available for such analyses. (Note: a version of DEIMS is publically available through Data Resources, Inc.; users must subscribe to the service and must pay the processing charges incurred.)

#### 7. Use of the System for Policy Analyses

The major drawback of DEIMS, from the standpoint of policy makers, is that it does not provide the whole picture. No estimates of the supplies of goods, labor, or materials are included in the DEIMS results. Thus, the crucial question of bottlenecks cannot be directly addressed. DEIMS does provide comparisons of industry growth rates, but as Forest noted, a high rate of growth may be normal for one industry (e.g., semiconductors), while a low rate of growth in demand in another industry may obscure fundamental problems of inadequate capacity.

Similarly, Fechter complained of the absence of data on the supply of skilled labor and Morgan noted the absence of data on private and government stockpiles of strategic and critical materials. Without a clear view of both demands and supplies, the results are of limited usefulness for policy. (Note: this limitation may be less important to the industrial users of DEIMS, who know better their own industries' capacities.)

## 8. Priorities for DEIMS Improvements

The following recommendations are based on the comments and criticisms offered at the conference:

(1) Establish a regular schedule for updating the DEIMS translator. Work with other OSD and Service offices to improve the usefulness of their administrative records for DEIMS. Make updating the Operation and Maintenance vectors a priority for the coming year.

(2) Begin the process of incorporating supply data in DEIMS by concentrating on those industries, labor groups, and materials in which DoD demands play the greatest role. In the first phase, supply estimates from external sources should be assembled and manually compared to DEIMS demand projections. Later these data might be incorporated into DEIMS software and computer generated reports.

(3) Sponsor research designed to develop a program of methodological improvements to the regional DEIMS. Introduce these improvements incrementally as resources and time permit.

(4) Establish a review panel involving personnel from DoD, other Federal Government agencies, and (as appropriate) experts from outside government to review the DEIMS results and make recommendations for changes. Involve the panel formally as a step in the forecast development, review, and release process.

(5) Disseminate DEIMS documentation more broadly and solicit comments on the system from the public.

**APPENDIX A**

**PROGRAM PARTICIPANTS  
ATTENDEES**



#### PROGRAM PARTICIPANTS

Dr. David Blond  
Department of Defense

Dr. George Brown  
Data Resources, Inc.

Dr. David Chu  
Department of Defense

Mr. Paul Dickens  
Department of Defense

Dr. Lawrence R. Forest  
Congressional Budget Office

Mr. David Henry  
U.S. Department of Commerce

Mr. Ronald Kutscher  
Bureau of Labor Statistics

Dr. John Morgan  
U.S. Bureau of Mines

Dr. Robert Rauner  
Office of Economic Adjustment, DoD

Mr. William H. Taft, IV  
Deputy Secretary of Defense

Dr. Douglas Brown  
Georgetown University

Mr. Joseph Cartwright  
U.S. Department of Commerce

Dr. William Cox  
Congressional Research Service

Mr. Alan Fechter  
National Academy of Sciences

Mr. Robert F. Hale  
Congressional Budget Office

Dr. Lawrence J. Korb  
Assistant Secretary of Defense

Dr. David L. McNicol  
Department of Defense

Dr. Karen Polenske  
Massachusetts Institute of Technology

Dr. George R. Schink  
Wharton Econometric Forecasting Associates

---

Dr. R. William Thomas  
Conference Organizer

Ms. Neang Ith  
Conference Coordinator

# ATTENDEES

Roderick Alderton  
General Electric Company

Joe Ambargis  
U.S. Department of Commerce

Thomas G. Augherton  
Republic Steel Corporation

Gregory Barthold  
ALCOA

Richard Beemiller  
U.S. Department of Commerce

James P. Bell  
Institute for Defense Analyses

Hugh P. Bradley  
Office of Industrial Base Assess.

Kwai-Cheung Chan  
U.S. General Accounting Office

Robert S. Clark  
U.S. Conference of Mayors

Nerissa J. Cook  
Federal Emergency Management Agency

William W. Crocker  
U.S. General Accounting Office

William E. Davis  
Department of Energy

George V.B. Day  
The Aluminum Association

Ralph Doggett  
Data Resources, Inc.

Eugene M. Ebner  
Office of Management and Budget

Len Famiglietti  
Air Forces Times

Myron Allen  
Department of Energy

Fred Arnold  
Data Resources, Inc.

Tom Barger  
Chase Econometrics

George Beckerman  
Beckerman Associates

Donald S. Bell  
Northeast-Midwest Cong. Coalition

Arthur F. Bondshu  
Department of Defense

George E. Breen, Jr.  
U.S. General Accounting Office

Koleen Cimmento  
Institute for Defense Analyses

Leon M. Cole  
Congressional Research Service

Glen Coplon  
Department of Energy

Bryan Curran  
Chase Econometrics

Donald Day  
U.S. General Accounting Office

Sally Dodge  
Wharton Econ. Forecasting Asso.

Charles P. Downer  
Consultant

John F. (Jack) Eck  
Department of Defense

Mark Forman  
U.S. General Accounting Office

Rita A. Friga  
Department of Defense

Cynthia E. Gonsalves  
Department of Defense

Gary Guenther  
Congressional Research Service

David Horne  
Army Research Institute

David L. Jones  
Hqs, Military Traffic Management Cmd.

Hugh Knox  
U.S. Department of Commerce

John Kort  
U.S. Department of Commerce

O. Cleveland Laird  
Federal Emergency Management Agency

Robert J. Lane  
U.S. General Accounting Office

Linda LeGrande  
Congressional Research Service

Margaret I. Leichtman  
NEMA

Debra A. Lindsey  
Federal Emergency Management Agency

John E. Lynch  
Department of Defense

William McNaught  
U.S. General Accounting Office

D. Anne Martin  
Emerg. Mobil. Prepare. Board

Sophia Mellos  
Data Resources, Inc.

Lynn Goldberg  
Wharton Econ. Forecasting Asso.

Charles W. Groover  
Department of Defense

Gregory G. Hildebrant  
The RAND Corporation

Neang Ith  
Institute for Defense Analyses

Wayne J. Kelly  
Computer Sciences Corporation

James H. Kordes  
Department of Defense

Vickie Kovski  
Illinois Department of Commerce

Hyder Lakhani  
Army Research Institute

Norma B. Leftwich  
Department of Defense

David P. Leech  
Institute for Policy Studies

William A. Lindsay, Jr.  
Lindsay Research Consulting

Virginia C. Lopez  
Aerospace Industries Association

Alice Maroni  
Congressional Research Service

Milton Margolis  
Department of Defense

Helen Maxwell  
U.S. Department of Commerce

Tom Miles  
ISSCO

Herald Mohr  
Department of Energy

Paul Murphy  
Defense Budget Project

Hughes Petteway, Jr.  
Allied/Bendix Aerospace

Maxine Richter  
Hqs, U.S. Army Dev. & Readiness Cmd.

Meg Sheridan  
Institute for Defense Analyses

Marsha Smith  
Federal Marketplace Services, Inc.

Melinda Suddes  
U.S. General Accounting Office

Scott Sutton  
Naval Materiel Command

William Thomas  
Institute for Defense Analyses

Ed Timberlake  
Department of Defense

John Tucker  
U.S. Department of Commerce

James R. Ukockis  
Treasury Department

William J. Weida  
Department of Defense

Harry Williams  
Institute for Defense Analyses

John J. Mulhern  
CACI

Inja Paik  
Department of Energy

Paul Richanbach  
Institute for Defense Analyses

Ed Schmits  
Army Research Institute

Tina Silverman  
Department of Defense

James H. Solomon  
U.S. General Accounting Office

Paige Sullivan  
U.S. Department of Commerce

William Taylor  
Office of Senator Bill Bradley

John C.F. Tillson  
Department of Defense

Edward A. Trott, Jr.  
U.S. Department of Commerce

John T. Tucker  
Bureau of Labor Statistics

Bill Warner  
Small Business Administration

Arthur D. Wells  
Cypress International, Inc.

Randall H. Workman

**APPENDIX B**

**REMARKS OF ASSISTANT SECRETARY OF DEFENSE LAWRENCE J. KORB**

## THE DEFENSE BUDGET

### CONFERENCE ON IMPACTS OF DEFENSE SPENDING

LAWRENCE J. KORB

May 8, 1984

#### I. Introduction

My topic this morning is the size and structure of the defense budget, and its evolution over the past thirty years. Later this morning, several speakers will present DoD's findings on the impact of defense spending on specific industries and geographic regions. But in order to understand what kind of influence defense dollars have on the economy, we first need to know something about how those dollars are spent, because different parts of the Defense budget affect the economy in different ways.

- o Some types of defense purchases draw upon idle capacity, while others must compete for scarce resources.
- o Some pump money into the economy immediately, while others do so over a period of years.
- o Some are subject to sharp fluctuations from one year to the next, while others remain more stable.

But first, before we turn to the composition of the budget, we need to put the overall level of spending in perspective.

## II. The Level of Defense Spending

As most of you are aware, the unified federal budget provides two very different measures of the defense budget in any given year: the amount of spending authority, and the actual level of spending.

(Chart 1)

- o Budget Authority is the Department's legal authority, conferred through the Congressional appropriations process, to incur obligations. In the case of DoD, that means the authority to award contracts, place orders, or take receipt on goods and services (including the employment services of its employees).
- o Outlays are actual payments, usually in the form of checks written by the Treasury.

As you can see from the chart, the budget authority granted in FY 1985 will exceed actual outlays in FY 1985 by more than \$40 billion.

Of course, if all of DoD's purchases were delivered and paid for immediately, these two measures of the defense budget would be identical. Indeed, that is very nearly the case for one type of defense spending--the

# MEASURES OF THE DEFENSE BUDGET

## FISCAL YEAR 1985

---

BUDGET AUTHORITY \$305.0 B

OUTLAYS \$264.4 B

BUDGET AUTHORITY:

DoD's LEGAL AUTHORITY TO AWARD CONTRACTS,  
PLACE ORDERS, OR TAKE RECEIPT ON GOODS AND  
SERVICES

OUTLAYS:

ACTUAL PAYMENTS

| 3584-4



compensation of employees, who are paid within a few weeks of rendering labor services to DoD. Consequently, the amount of budget authority and the amount of outlays for employee compensation in any given year are very nearly identical.

But major defense systems take years to produce, so the budget authority that authorizes the original contract award is typically paid out over several different fiscal years. It is these lags in payment that give rise to the difference between budget authority and outlay totals.

To see why, imagine for the moment that the contracts signed in one year are always paid out in the following year. Then whenever the budget is growing, outlays will be less than budget authority: the outlays that pay for last year's contracts will be less than the budget authority that authorizes this year's contracts. By the same token, whenever the budget is shrinking, outlays will tend to be greater than budget authority.

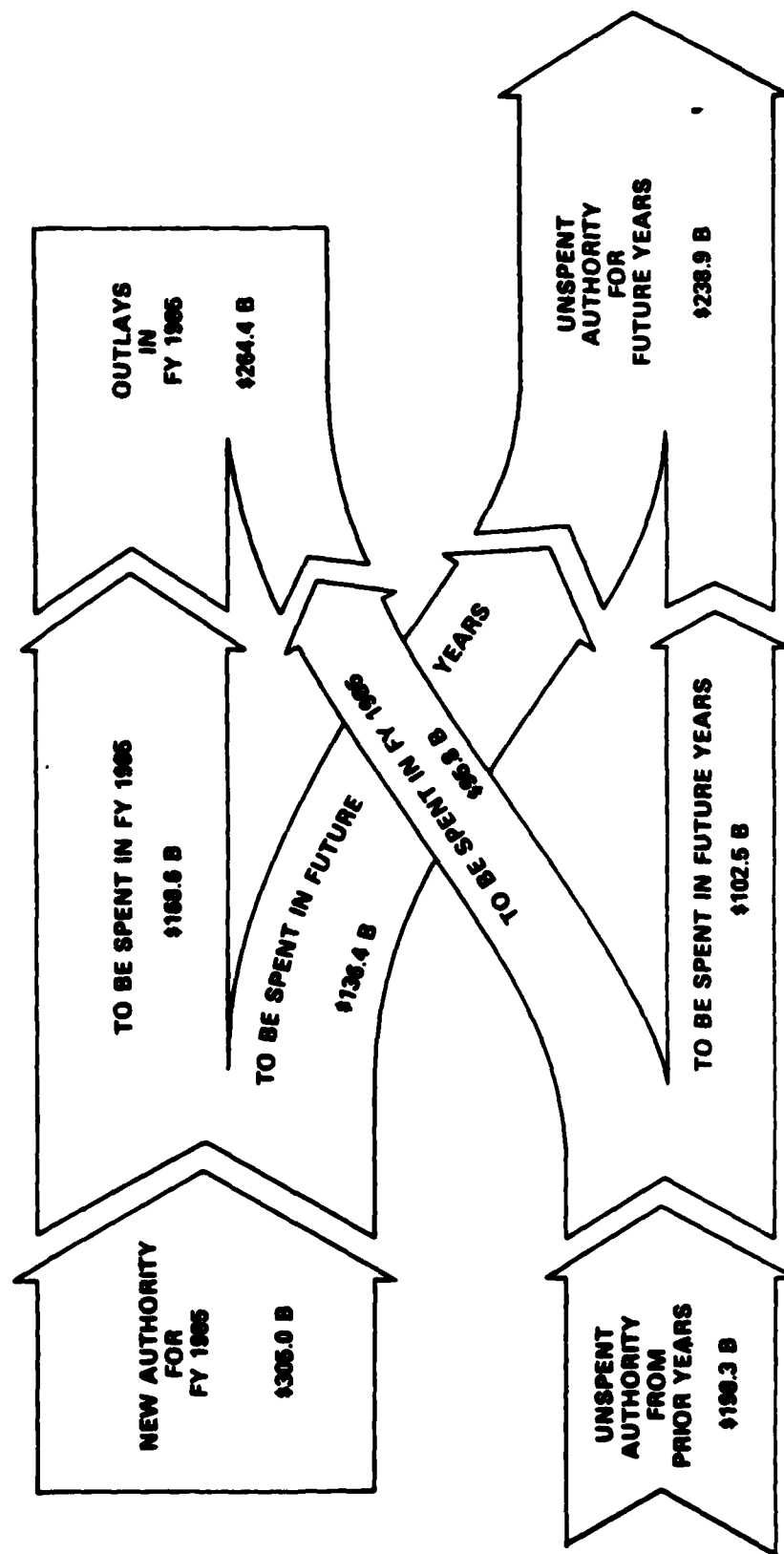
The actual picture, of course, is somewhat more complicated.

(Chart 2)

Outlays for FY 1985 appear in the upper right corner of the chart; new budget authority granted in FY 1985 appears in the upper left. These are the figures that we saw in the previous chart. As you can see, just over half of the new budget authority, or \$168.6 billion, will be spent in the current fiscal year. The balance will be carried forward to be paid out in future

# RELATIONSHIP OF BUDGET AUTHORITY TO OUTLAYS

## FY 1985 DoD BUDGET



3584-4

years, while a slightly smaller amount of old budget authority carried forward from previous years will be spent in FY 1985. Meanwhile, more than \$100 billion in budget authority authorized in previous years will be carried forward to be spent in future years. (Most of the funds carried forward from one year to the next meet obligations created by contracts already signed; a fraction of the funds are carried forward as unobligated balances.)

Note that the total amount of budget authority available in FY 1985, including both obligated and unobligated balances, is \$503.3 billion: well in excess of actual outlays. But that full amount could not be spent in FY 1985 without cutting into the resources needed for long-term defense programs. And, of course, some of it is already committed to pay bills, for contracts already signed, that will come due in future years.

It is clear from the chart that budget authority and outlays are very different concepts. Which provides a better measure of the defense budget? There is no simple answer; it depends on the specific question we are asking. Outlays, since they represent actual payments that inject money into the economy, are probably better for making comparisons with measures of total economic activity such as GNP. But budget authority, since it represents the authority to place orders, is probably better for measuring the full, long-term impact of the budget on the private sector. Producers generally do not wait for payment before they decide how they will employ their resources; they make their investments and set their production schedules on the basis of contracts offered and signed. Later on, when we look at the specific composition of the defense budget, we will do so in terms of obligational authority.

### III. Growth in the Defense Budget

(Chart 3)

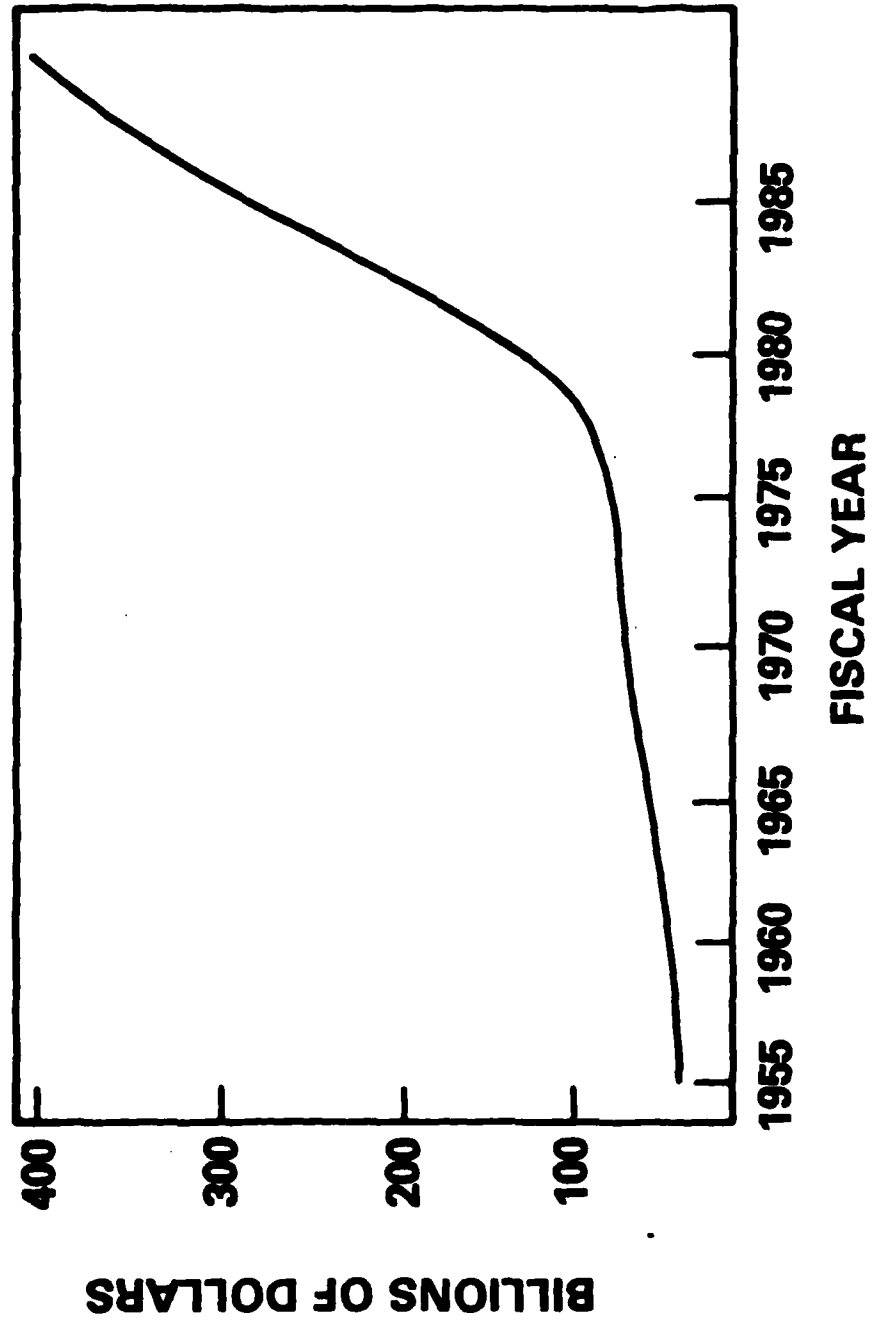
How does the current defense budget compare with previous years? The chart displays Defense Department outlays during the postwar era, including projections through FY 1989. It seems to show substantial, almost uninterrupted growth.

- o In FY 1955, Defense Department outlays totaled \$35 billion.
- o In FY 1985, outlays will reach \$264.4 billion, almost an eight-fold increase in 30 years.
- o The average annual rate of growth in defense spending during that period was 7 percent.

But that picture of vigorous growth in defense spending ignores the erosion in the purchasing power of the dollar caused by inflation. In that same 30 year period, consumer prices quadrupled. The price level for defense goods rose even more: enough to offset all but 7 percent of the nominal increase in DoD's outlays. In fact, despite the apparent increase, the Defense Department's budget, measured in terms of what it could actually buy, was no larger in 1980 than it was in 1955.

# NOMINAL DoD OUTLAYS

FY 1955-1989



In order to see how the actual purchasing power of the defense budget changed over time, we have to express outlays in inflation-adjusted, constant dollars. If we do so, the picture changes dramatically.

(Chart 4)

We still see substantial real growth in the 1980s. But when we look at the long-term trend through the 1950's, 60's and 70's, ignoring the temporary bulge in spending associated with the Vietnam War, we see that the growth in the 80's follows 25 years of no real growth at all.

Of course, the economy grew a great deal in that time, and so did the federal budget. That means the fraction of our productive resources devoted to national defense actually declined over the period as a whole.

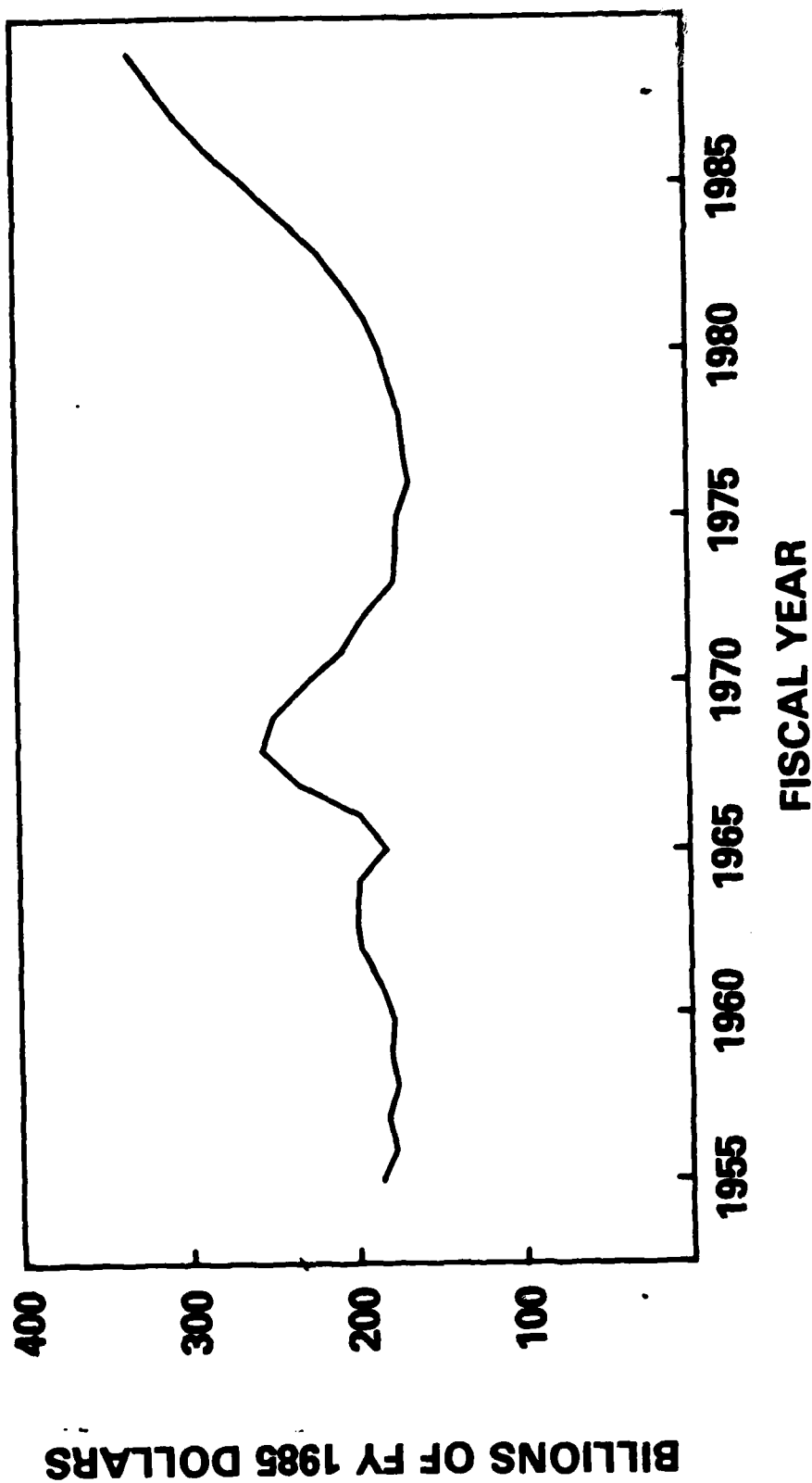
(Chart 5)

- o In FY 1955, defense spending was more than half the federal budget. By the end of the 1970's, it had fallen below a quarter of the budget.
- o In that same period, defense spending declined from 9.2 percent to 4.9 percent of gross national product.

It seems reasonable to assume that as our economy grows, so should our investment in its security. But our defense investment has not kept pace with our economy. Viewed in this light, the pattern of defense spending from 1955

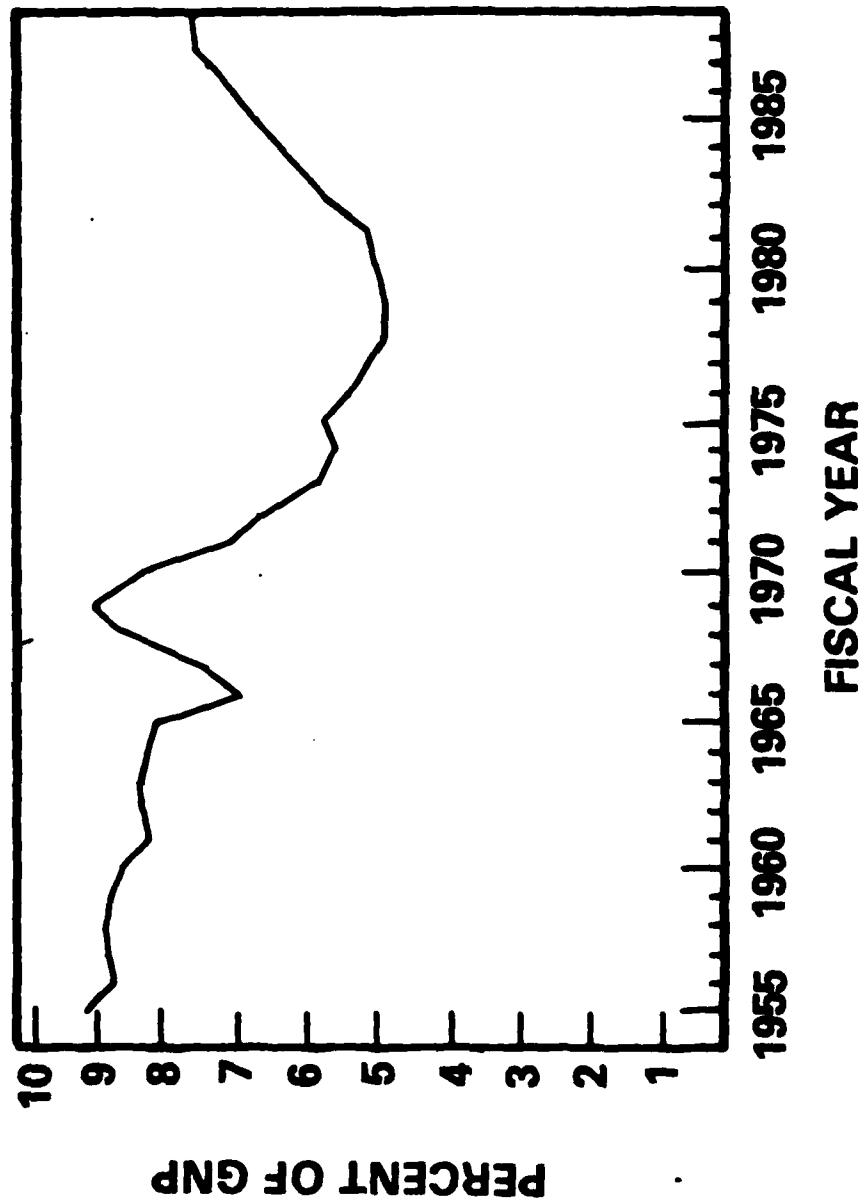
# **DoD OUTLAYS IN CONSTANT FY 1985 DOLLARS**

**FY 1955-1989**



3564-4

# DoD OUTLAYS AS A SHARE OF GNP FY 1955-1989



3584-4



to 1980 appears as exactly the reverse of what it seemed a moment ago: instead of steady growth, a steady decline in the relative level of resources devoted to national security.

And, looking again at the chart, our defense spending for the 1980's, the size of which has been the subject of so much debate, only begins to reverse the decline of the past 25 years. As a fraction of total economic activity, it is well below the investment that we have made in the past.

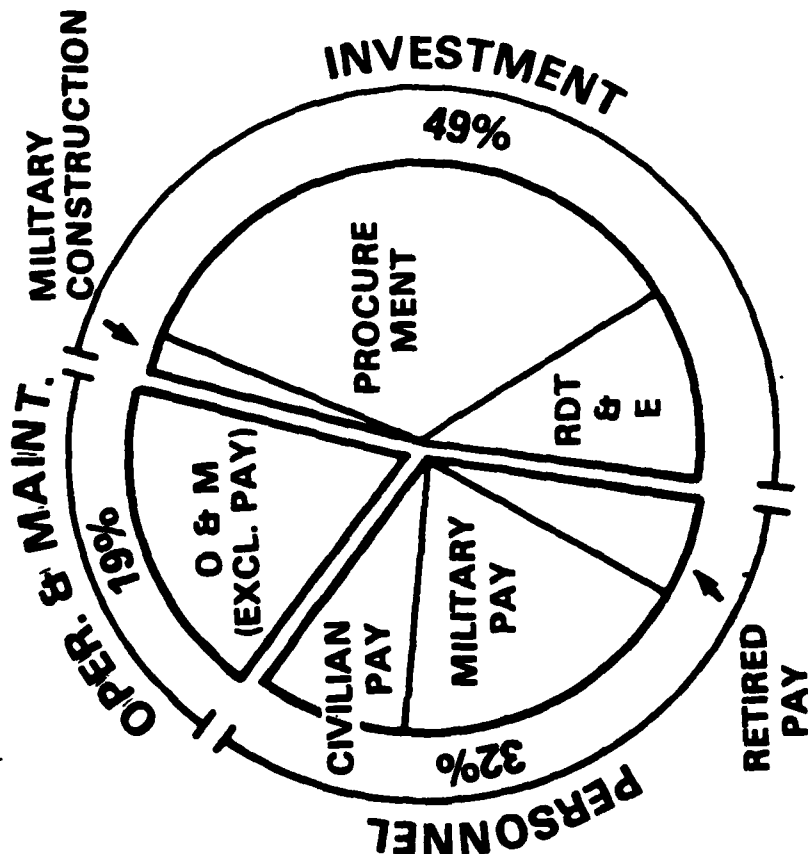
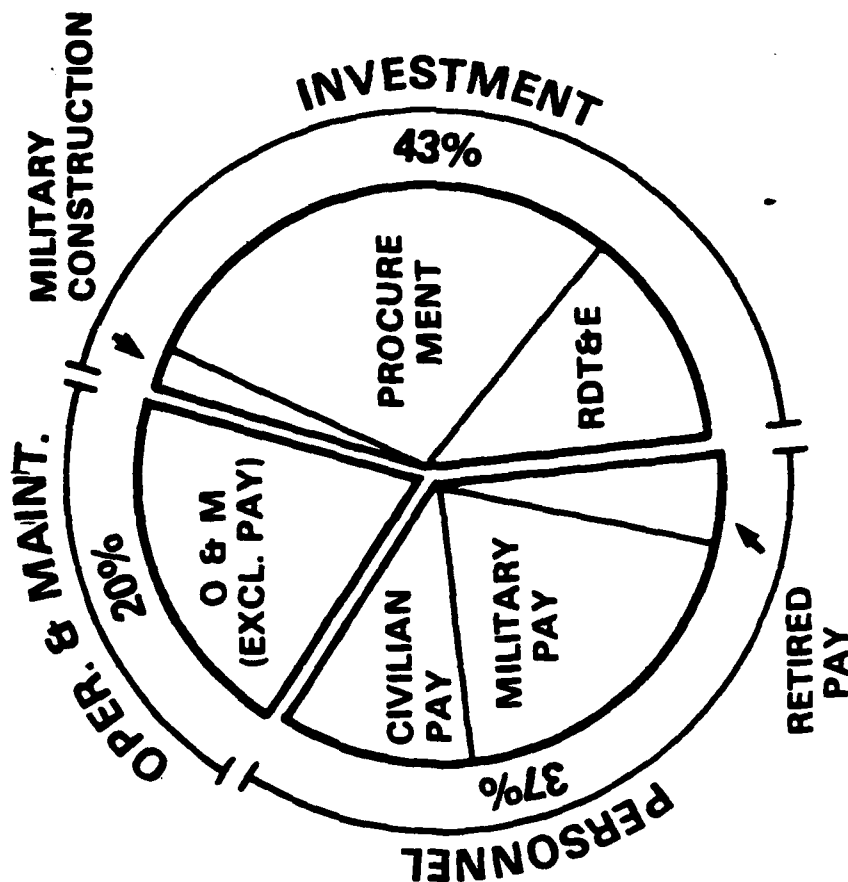
#### IV. Breakdown by Budget Category

The pattern of growth has not been the same for all parts of the defense budget. Nor does each part of the budget have the same effect on the private economy. As we probe more deeply, we will find it convenient to break the budget down into three broad categories: personnel, operations and maintenance, and investment.

(Chart 6)

- o Personnel includes military pay and allowances, retired pay, and civilian pay. This category includes fringe benefits and military housing allowances, as well as payroll.
- o Operations and Maintenance covers base operations, training, maintenance, replenishment spare parts, fuel, and a host of other activities that support the operational readiness and sustainability of our armed forces.

# FY 1985 DEFENSE BUDGET BY BUDGET ACCOUNT



OUTLAYS

BUDGET AUTHORITY

3584-4

- o Investment covers the development and acquisition of weapons and other major military systems, corresponding to the standard budget accounts of procurement and RDT&E (Research, Development, Test, and Evaluation). As used here, investment also includes the relatively small amount budgeted for construction of military installations.

I should point out that I am using a slightly different classification from the one that is commonly found in breakouts of DoD's budget accounts. About one-third of the standard O&M budget account total consists of pay and pay-related expenses, which I have classed instead as a personnel expense. In fact, almost all of DoD's civilian pay is included in the O&M accounts, while the so-called "pay" accounts, in our budgeting systems, refer more or less exclusively to military pay and allowances. But for our purposes, it is more convenient to group together all pay and pay-related budget categories, since they are handled together in modeling the economic impacts of defense spending.

I should also note that the military retired pay accounts, which make up nearly one-fifth of all pay and pay-related defense spending, are now in the process of being converted to an accrual basis. The change in accounting procedures was directed by the FY 1984 defense authorization act, and it takes effect with the FY 1985 budget. It means that actual payments of benefits to retired military personnel will no longer be included in DoD's budget. Instead, each of the armed services will be charged for the accruing retirement benefits of current military personnel. These charges will be paid into a retirement fund, maintained outside the Defense Department, in much the

same way that the civil service retirement fund now operates. This represents a substantial change in DoD accounting procedures, but I bring it up here only as a minor footnote, since the change has no effect on the outside economy.

We have already seen that the investment accounts are characterized by large lags between purchase and delivery, and that the personnel accounts involve virtually no such lags. The operations and maintenance accounts fall somewhere in between. Most operations and maintenance funds are paid out in the same year that they are obligated, and all but a small fraction of what remains is paid out in the following year. Thus most of the difference that we saw between budget authority and outlays in the DoD budget totals is traceable to the investment accounts.

The three budget categories can also be distinguished by the types of purchases that they fund. As you will hear later this morning, procurement--the largest item in the investment accounts--draws heavily on primary manufacturing industries that compete in national markets. As a result, the geographical distribution of procurement spending tends to mirror the location of manufacturing capacity throughout the United States, particularly when the funds that flow to subcontractors and suppliers are taken into account. Personnel and operations and maintenance, on the other hand, are more closely tied to the operations of DoD bases and installations.

Of the three categories, investment is the largest, accounting for 49 percent of FY 1985 budget authority. Personnel accounts for 32 percent of total budget authority, and operations and maintenance (excluding pay) accounts for the remaining 19 percent. (Investment outlays lag behind

obligations, as we have seen, and since defense investment has been growing in recent years, that lag gives investment a slightly smaller share of total outlays).

(Chart 7)

If we compare these three categories over time, in constant dollars, it is immediately apparent that personnel and operations and maintenance have held fairly stable, while investment has fluctuated more widely. The reasons for this will become apparent as we look at each category more closely, beginning with personnel.

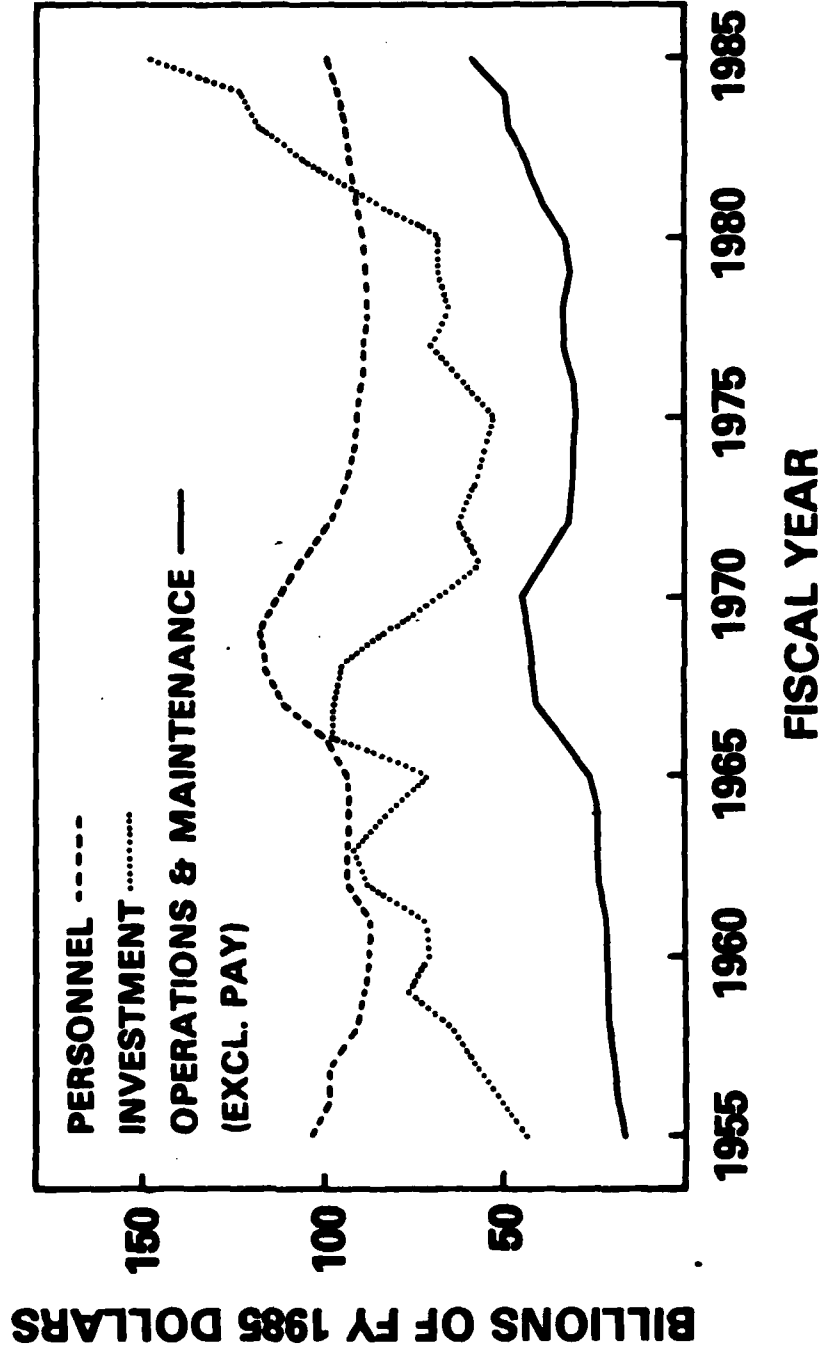
A. Personnel

(Chart 8)

The top chart shows that, in inflation-adjusted constant dollars, both military pay and allowances (including retired pay), and civilian pay and allowances have hardly changed since 1955. The bottom chart, which gives DoD manpower levels since 1955 shows several gradual trends: a decline in force levels following the Korean War; followed by the Vietnam buildup; a resumption of the decline in the first half of the 1970's; and a slight increase in the 1980's.

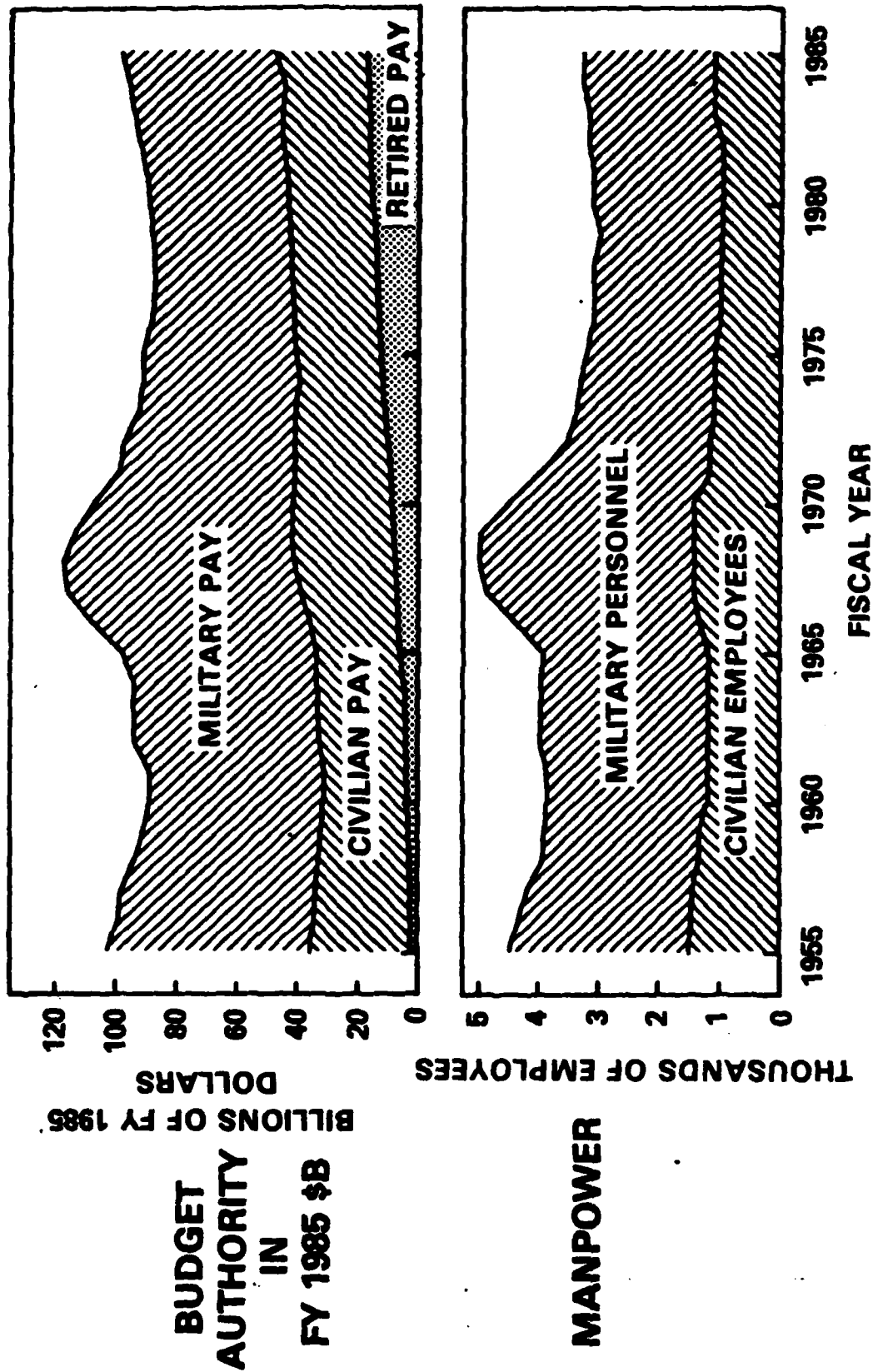
Over the period as a whole, the overall trend has been a modest decline in the number of personnel, both military and civilian (in contrast, by the way, with a steady increase in the number of employees at non-defense

# DoD BUDGET AUTHORITY IN CONSTANT FY 1985 DOLLARS FY 1955-1985



3564-4

# DoD PERSONNEL FY 1955-1985



3564-4

agencies). That decline has been largely offset, however, by an increase in pay rates over the period.

What is perhaps most striking, though, is the large fraction of the Defense Department's budget that is devoted to personnel. Salaries are a fixed expense, to some degree, for all federal agencies; but that expense consumes one-third of the Defense Department's budget, compared to about 5 percent for non-defense agencies. That represents a sizeable fraction of the defense budget, which cannot be cut by more than a small margin unless we are willing to cut back at the same time on our defense commitments at home and abroad.

#### B. Operations and Maintenance

(Chart 9)

The operations and maintenance budget pays for the fuel, supplies, replenishment spare parts, maintenance, and services that keep our military units trained and their equipment running. This is the most mundane part of the defense budget--not as visible as airplanes, tanks, or ships--but it is the principal determinant of our operational readiness and our ability to sustain military operations under wartime conditions.

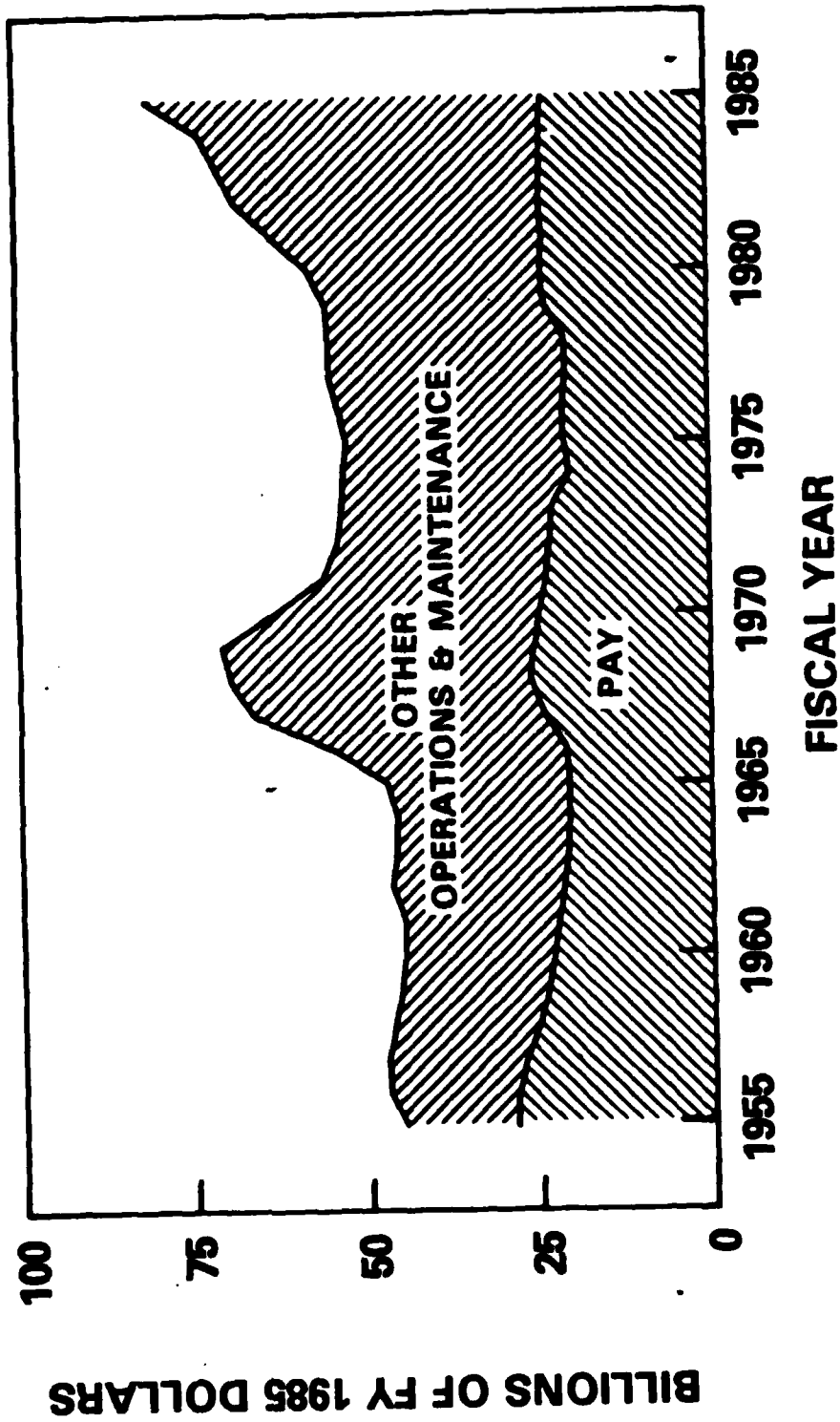
The operations and maintenance budget also pays for central administration and support, including most of the cost of running the Department of Defense here in Washington. These centralized administrative



# DoD BUDGET AUTHORITY FOR OPERATIONS AND MAINTENANCE

IN CONSTANT FY 1985 DOLLARS

FY 1955-1985



3564-4

expenses have remained relatively stable over time. During periods of expansion in defense spending, they tend to grow less rapidly than the budget as a whole.

Readiness and sustainability, on the other hand, are key elements in our military force structure. We would normally expect that part of the operations and maintenance budget which supports them to grow rapidly when our defense needs are growing, but that has not always been the case. That is because readiness and sustainability are measured in terms of spare parts and equipment in parts bins and supply warehouses, where their contribution to national security is out of sight and easy to ignore. Similarly, training and military exercises are intimately related to both readiness and sustainability, but their contribution to military capabilities is largely intangible. Finally, as I noted earlier, most operations and maintenance funds are paid out in the same year they are obligated, so they are easy to defer, and show up as dollar-for-dollar reductions in outlays. For all of these reasons, operations and maintenance has in the past been a perennial target of budget-cutting measures, aimed at the readiness, as well as the general administrative portions of the operations and maintenance budget.

This is a shortcoming of past defense policies that we have done our best to remedy. During the current buildup, the readiness and sustainability portions of operations and maintenance have grown rapidly, keeping pace with our acquisitions, a fact that may be obscured by the relative lack of growth in administrative overhead.

C. Investment

(Remove chart)

Investment--the development and acquisition of weapons and other major systems--is the largest, and, along with the readiness portion of operations and maintenance, one of the fastest-growing parts of the defense budget. It is also in many ways the most visible part of the Defense budget, and certainly has the most direct effect on the industrial sector.

Unlike personnel and much of operations and maintenance, which are typically supplied and paid for in the same year they are obligated, investment typically buys complex products that take several years to produce. This has three important consequences.

First, if investment needs are neglected for more than a short time, and defense stocks are allowed to become obsolete or numerically inadequate, the national security will be impaired for several years until the deficiency can be made up. The consequences of having to face a sudden conflict under such circumstances, lacking adequate armaments to support our forces, could be serious indeed.

This is true of all defense inputs to some extent, but the case of investment is unique. While it can be expensive to hire large numbers of skilled personnel quickly, for example, it is simply impossible to design and build a major weapon system in a year,

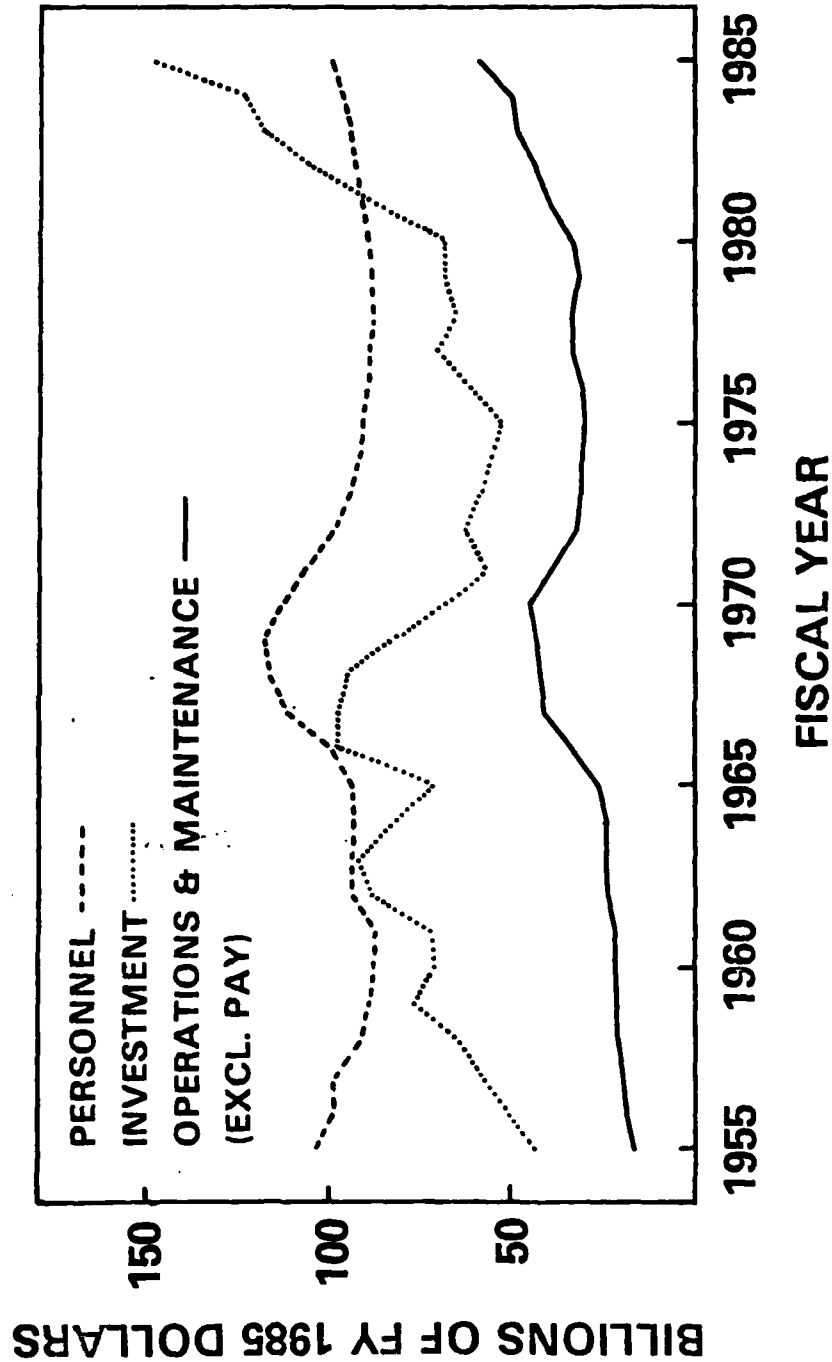
Second, as I discussed earlier, most new acquisitions, which seem to offer large opportunities for budget-cutting, actually generate relatively little spending in the year the obligation is made. The FY 1985 budget contains \$107.6 billion in new budget authority for procurement programs, for example, but only \$14.2 billion of that, or a little more than 13 percent, will be paid out in FY 1985. Most procurement outlays in any given year are the result of prior-year obligations, and are therefore nondiscretionary. Thus massive cuts in procurement programs would be required to bring about appreciable reductions in procurement outlays.

That brings me to my third point. Because only a small fraction of investment outlays are discretionary, efforts to cut total investment outlays tend to slow new investment to a trickle, making it necessary to stretch out or even curtail production, which almost always results in less efficient operations and higher unit costs.

(Chart 10)

We saw earlier that investment has in fact fluctuated widely over the past 25 years, compared to relatively stable funding for personnel and operations and maintenance. These fluctuations are disruptive to the industries that produce defense goods, and raise the cost of procurement in

# DoD BUDGET AUTHORITY IN CONSTANT FY 1985 DOLLARS FY 1955-1985



the long run. By the same token, stable investment budgets tend to maintain a reliable production capacity which can be called upon in time of national need.

Each of these three consequences of the gradual payout of investment contracts points to the need to adopt a consistent long-term investment program, and to resist efforts to change course in mid-stream.

#### V. Defense Budget and National/Regional Economies

The Department of Defense is conscious of the effects that defense spending has on the economy, and we are anxious to learn more about precisely where those effects are felt. To that end, the Department has developed the Defense Economic Impact Modeling System, which you will be hearing about in detail today. This modeling system enables us to assess the effects of the Defense budget on the overall national economy, on specific individual industries, on key labor and manpower skills, and on individual states throughout the nation.

The Department of Defense also has a special responsibility to ensure that new firms have a full opportunity to enter the defense market. During FY 1983, for instance, the Department awarded \$22.8 billion in prime contract awards to small businesses and another \$15.1 billion in subcontract awards to small and minority firms. The Department is also working with the U.S. Conference of Mayors, the Academy of State and Local Government, the National

Council on Urban Economic Development, and other public interest groups to assist state and local communities in their efforts to encourage local firms to seek Defense contracting opportunities. This initiative is set forth in a publication on Defense Procurement and Economic Development, issued by the President last May, and it represents a healthy cooperative effort with public interest groups to broaden the Defense industrial base.

## VI. Conclusion

But, in closing, I want to make it clear that our efforts in this area are not intended to favor any one set of firms, or any given geographical region, over another. Our purpose is to encourage the broadest possible participation in defense production, because we believe a broader industrial base, and more vigorous competition, will provide the security that we need at the lowest possible cost to the taxpayer. While we make every effort to be sensitive to the effects of defense spending on the broader economy, I want to stress that budget formulation at the Department of Defense is based on our evaluation of the threats that we and the commitment that have made national security.

**APPENDIX C**

**BRIEFING CHARTS FOR THE DEIMS FORECAST PRESENTATIONS**



TABLE 1

PROJECTED DEFENSE PURCHASES OF ELECTRONIC COMPONENTS NEC, 1984-1989  
(In millions of 1982 dollars)

	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>
	<u>Summary</u>					
Defense Purchases						
Direct <u>a/</u>	269	303	339	383	421	451
Indirect <u>b/</u>	<u>6,750</u>	<u>7,978</u>	<u>9,198</u>	<u>10,131</u>	<u>10,768</u>	<u>11,311</u>
Total	7,019	8,281	9,537	10,514	11,189	11,761

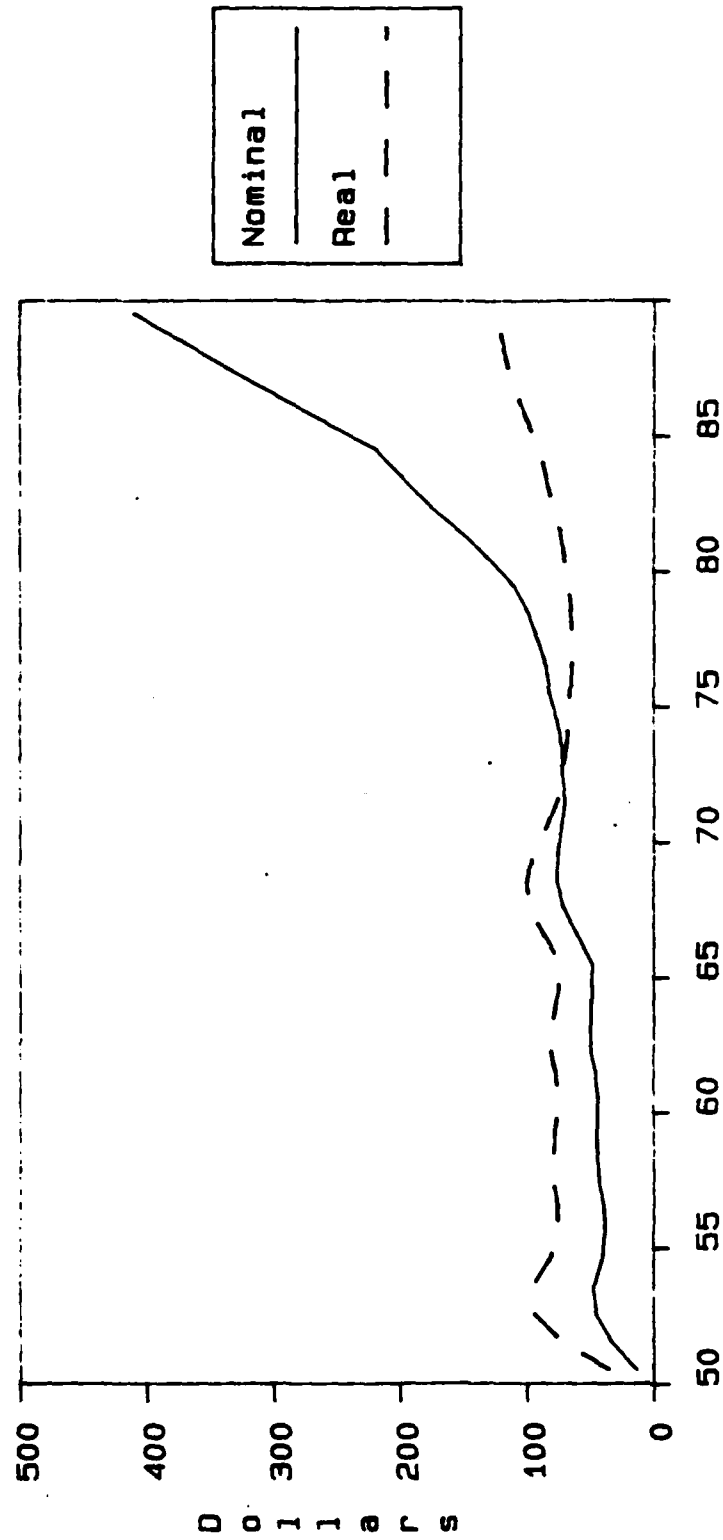
Indirect Defense Purchases by Purchasing Sector c/

Missiles	280	333	389	431	467	497
Ammunition	23	27	31	37	43	48
Tanks and Tank Components	40	45	48	52	55	57
Other Ordnance	30	34	38	41	42	43
Communications Equipment	3,496	4,073	4,659	5,203	5,656	6,010
Other Electronic Equipment	1,426	1,725	2,035	2,280	2,458	2,613
Motor Vehicles	14	17	18	19	21	22
Aircraft and Parts	1,032	1,252	1,450	1,499	1,428	1,391
Aircraft Engines and Parts	41	49	56	60	62	63
Shipbuilding	78	89	99	111	122	133
All Other	<u>290</u>	<u>335</u>	<u>373</u>	<u>398</u>	<u>415</u>	<u>433</u>
Total Indirect <u>d/</u>	6,750	7,978	9,198	10,131	10,768	11,311

Foreign Military Sales (FMS) e/

FMS (Direct plus Indirect)	661	562	573	583	594	603
-------------------------------	-----	-----	-----	-----	-----	-----

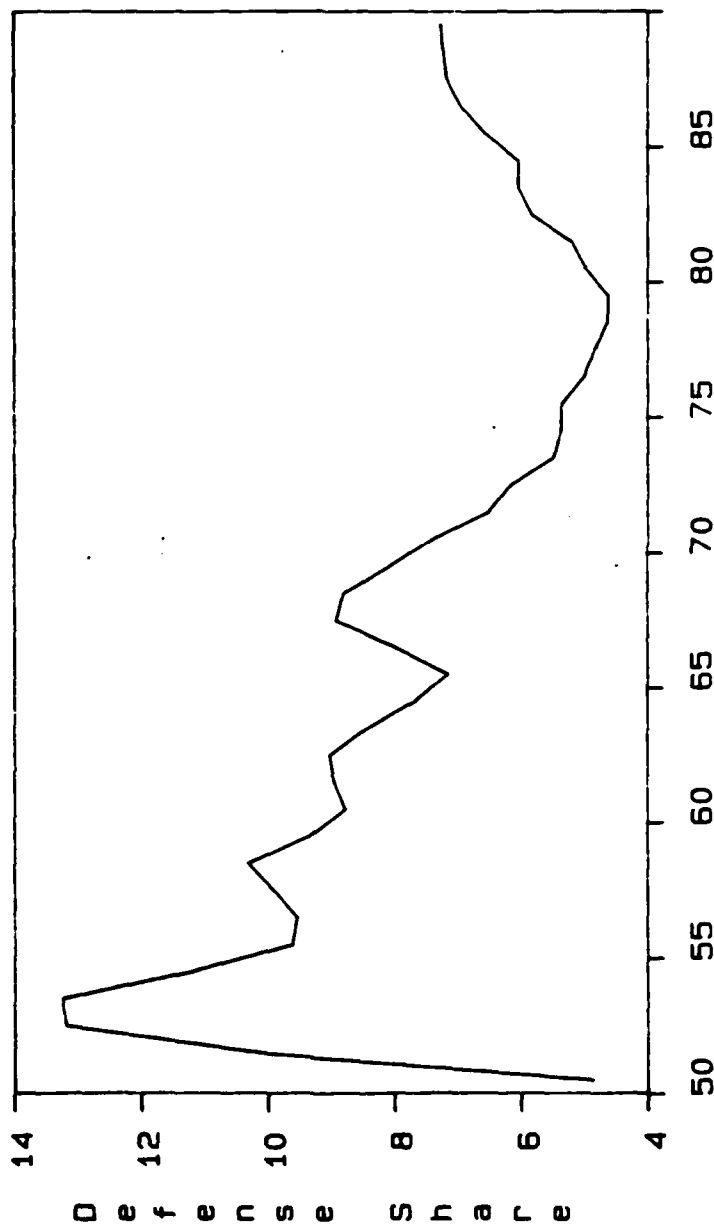
# DEPARTMENT OF DEFENSE OUTLAYS, 1950 - 1989



1950 to 1989

# DOD OUTLAYS AS A SHARE OF GNP

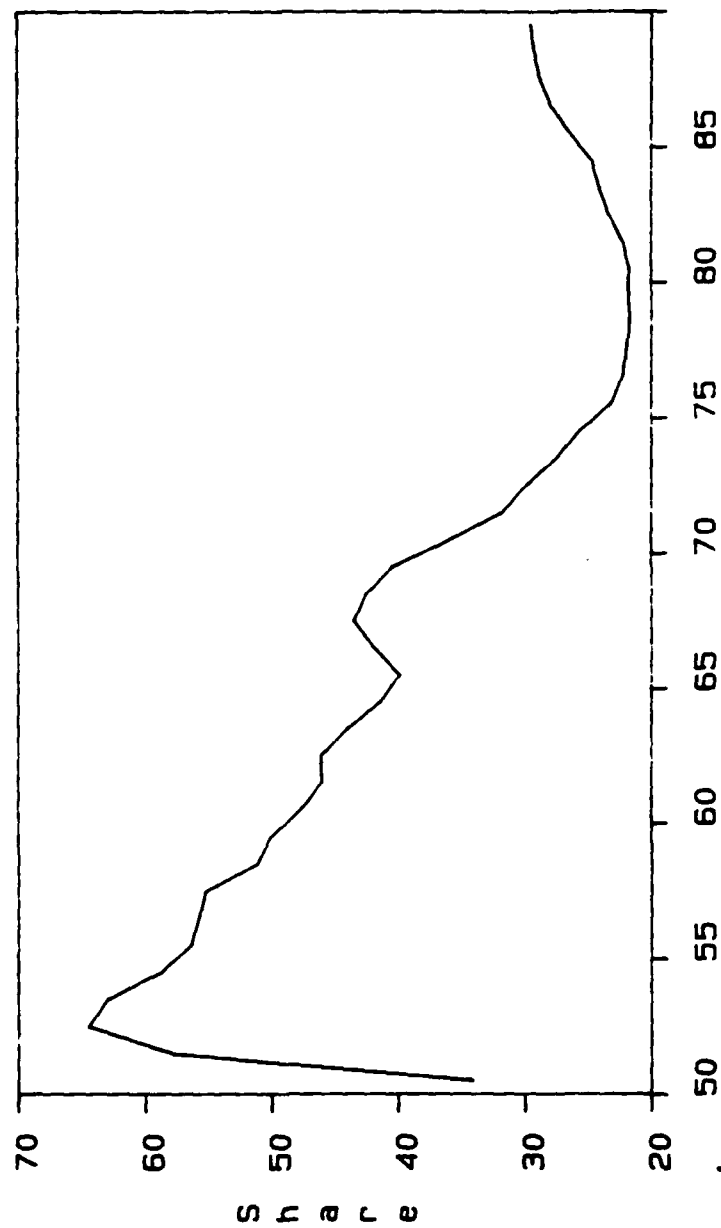
1950 to 1989



1950 to 1989

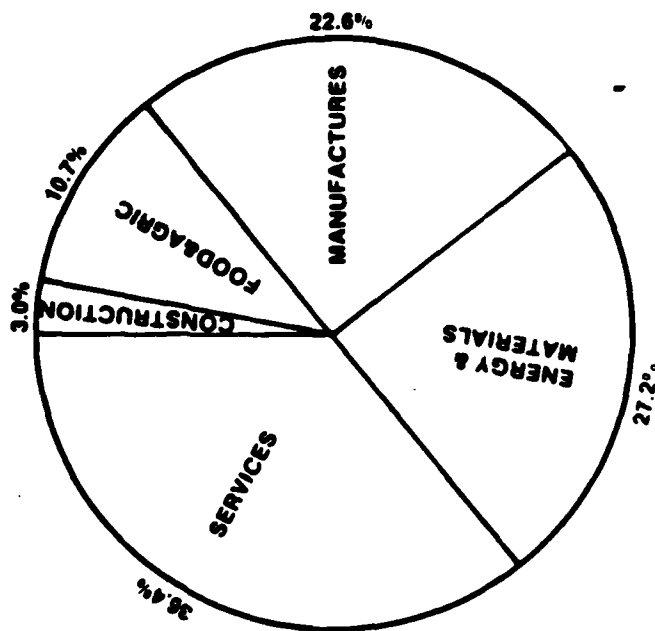
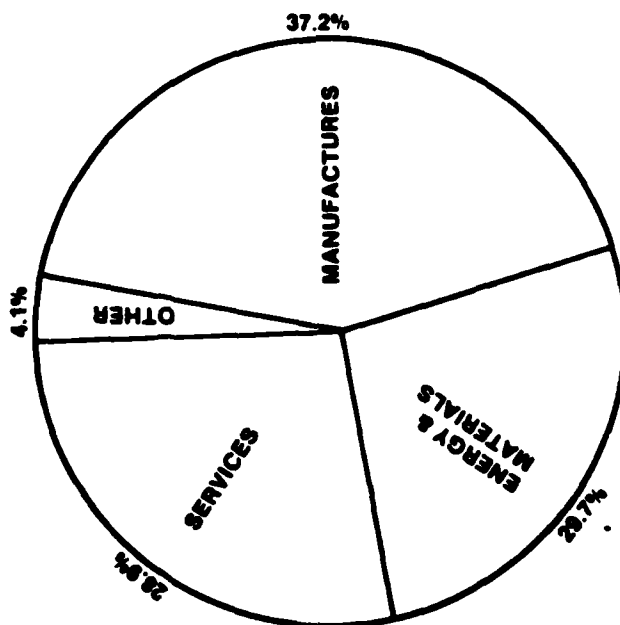
# DOD OUTLAYS AS A SHARE OF TOTAL FEDERAL OUTLAYS

1950 to 1989



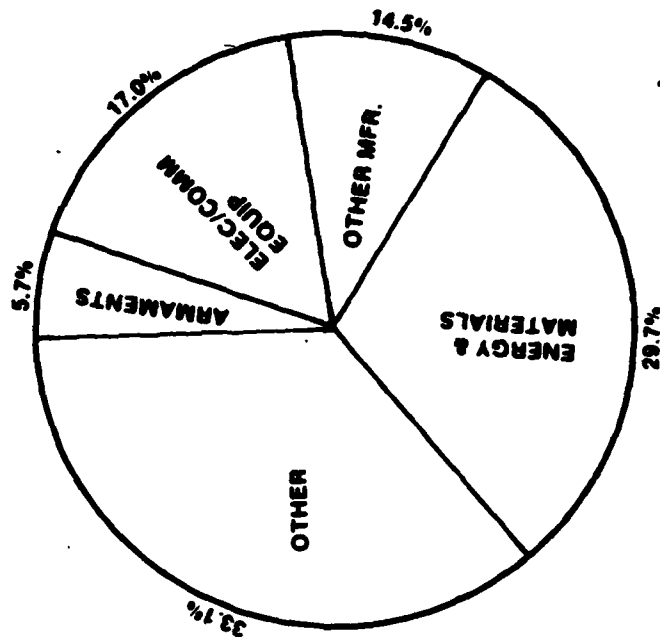
1950 to 1989

# DEFENSE AND NON-DEFENSE INDIRECT DEMAND 1985

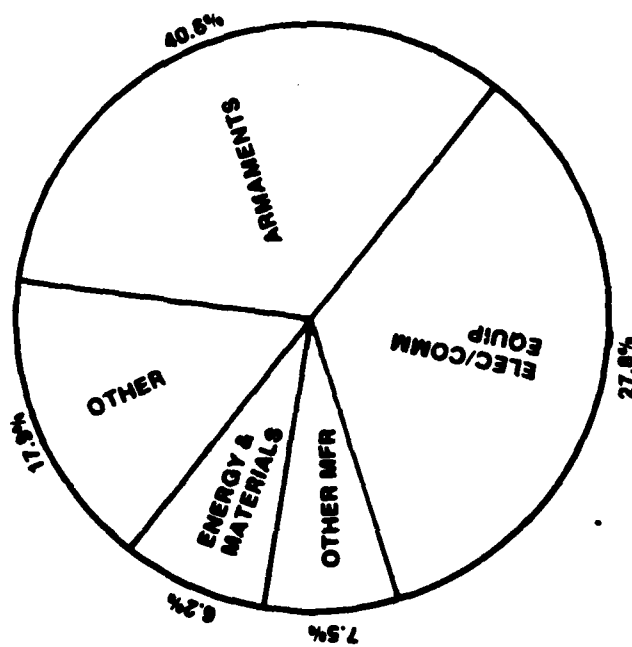


3574-4

# DEFENSE DIRECT AND INDIRECT DEMAND 1985

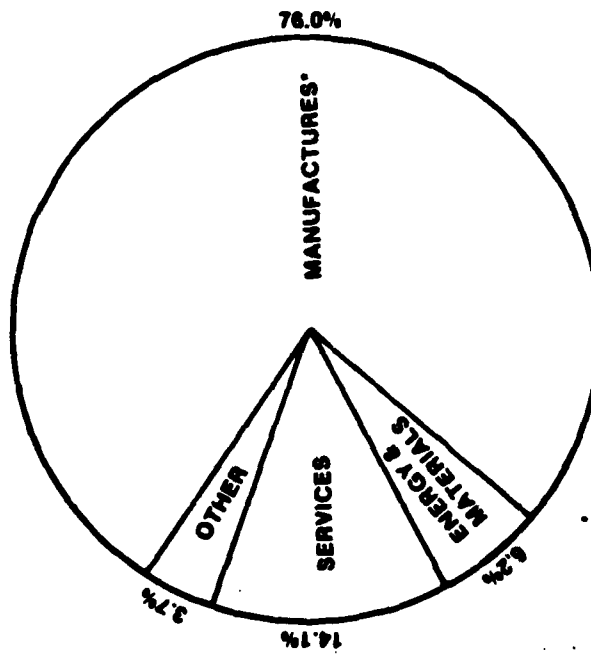


**INDIRECT**



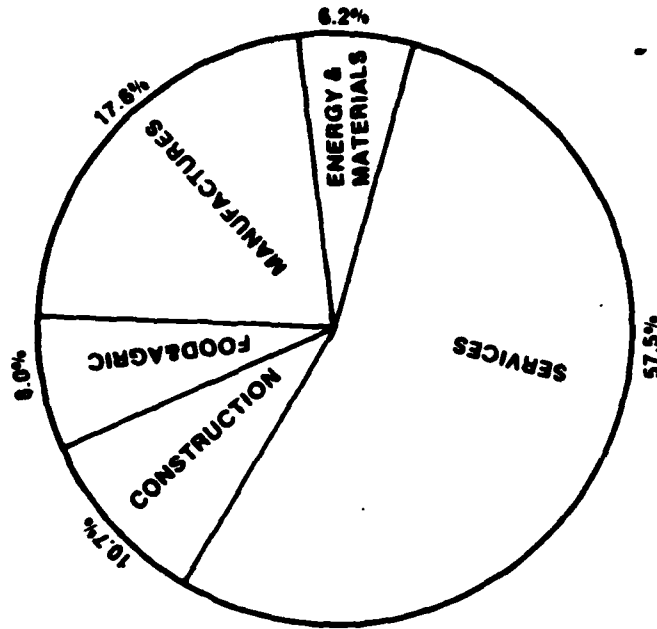
**DIRECT**

# DEFENSE AND NON-DEFENSE FINAL DEMAND 1985



**DEFENSE**

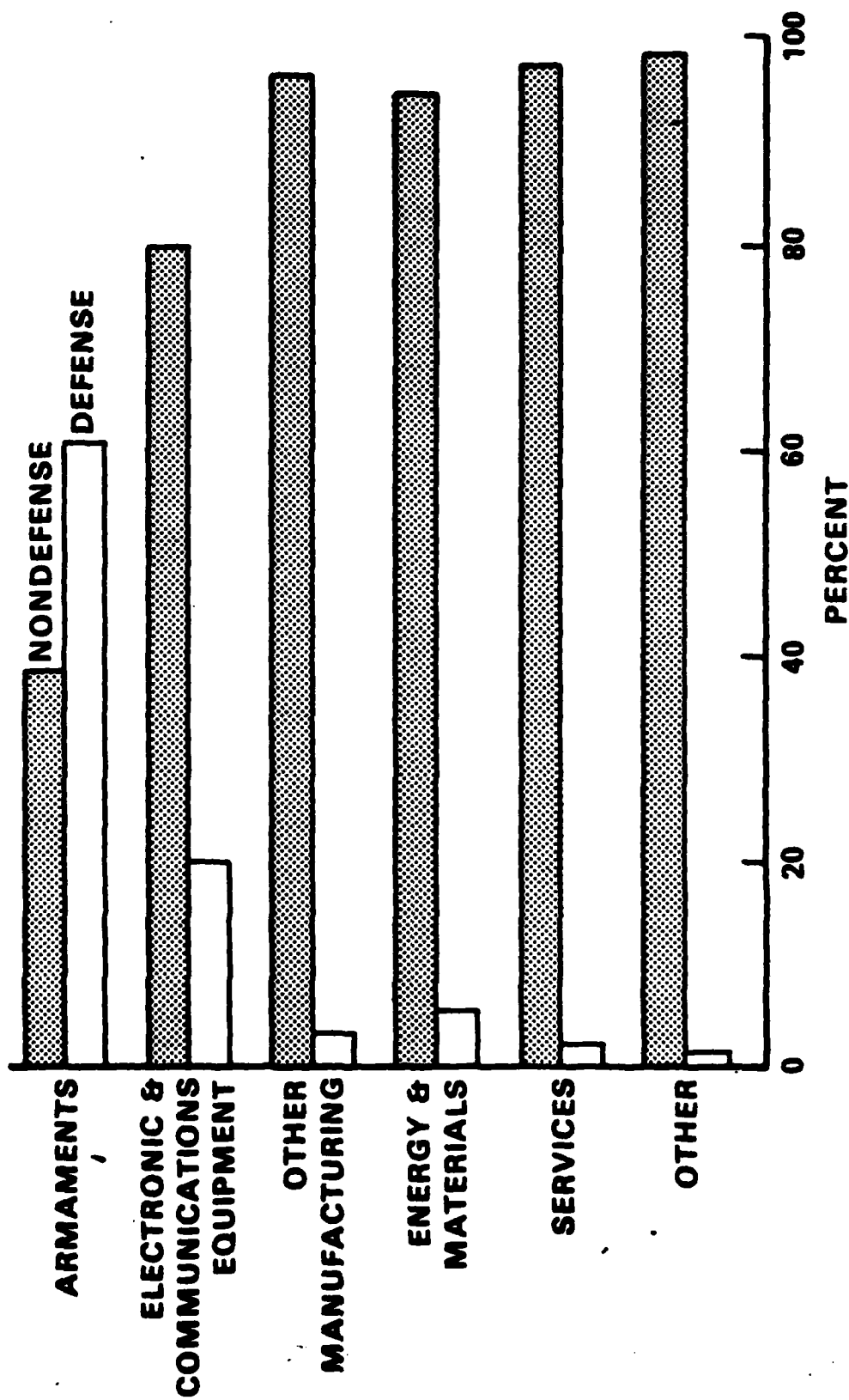
\*INCLUDES CONSTRUCTION OF NEW MILITARY FACILITIES.



**NON-DEFENSE**

3574-4

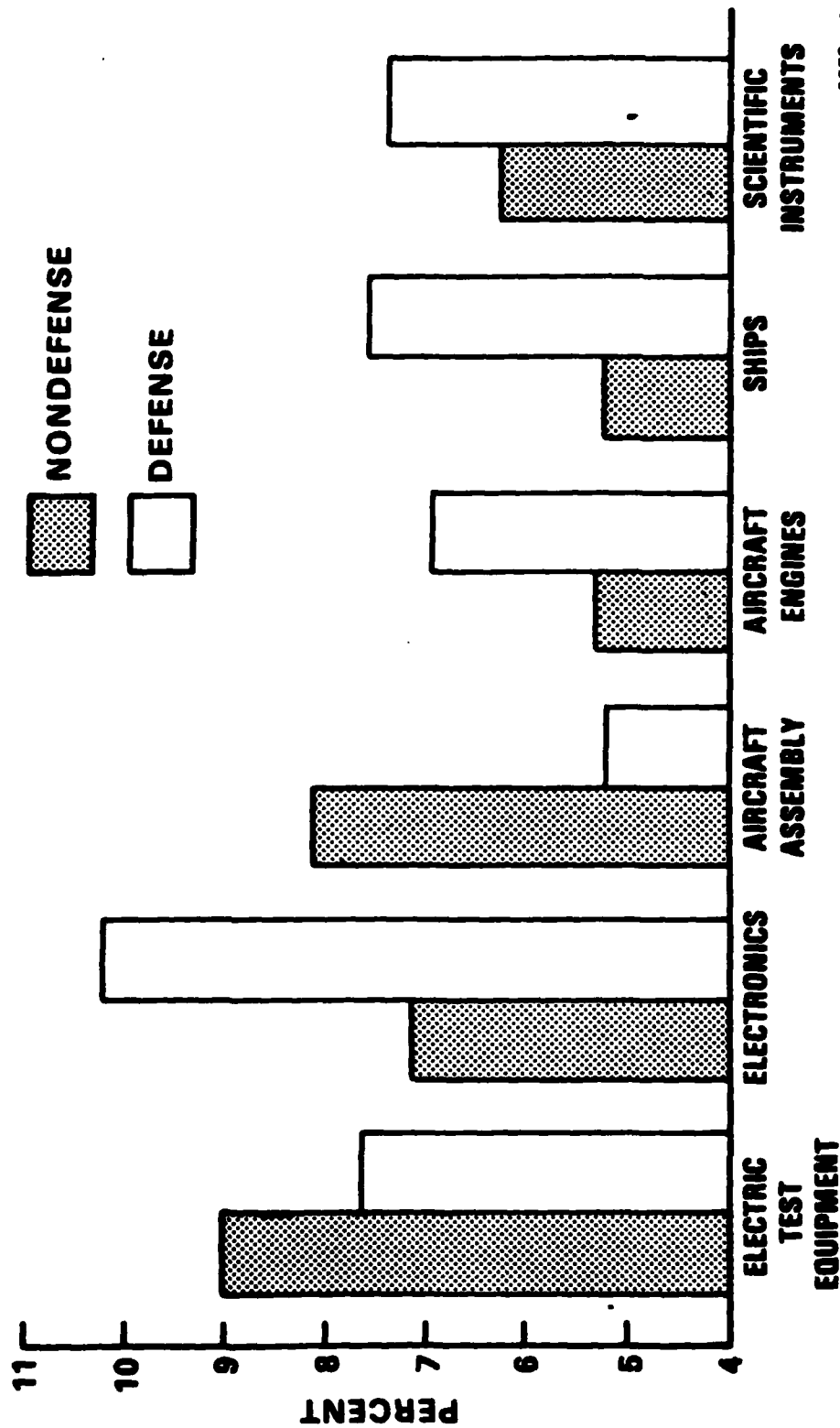
# DEFENSE AND NONDEFENSE SHARES OF SECTOR OUTOUT





# COMPARISON OF DEFENSE AND NONDEFENSE PRODUCTION DEFENSE INTENSIVE INDUSTRIES

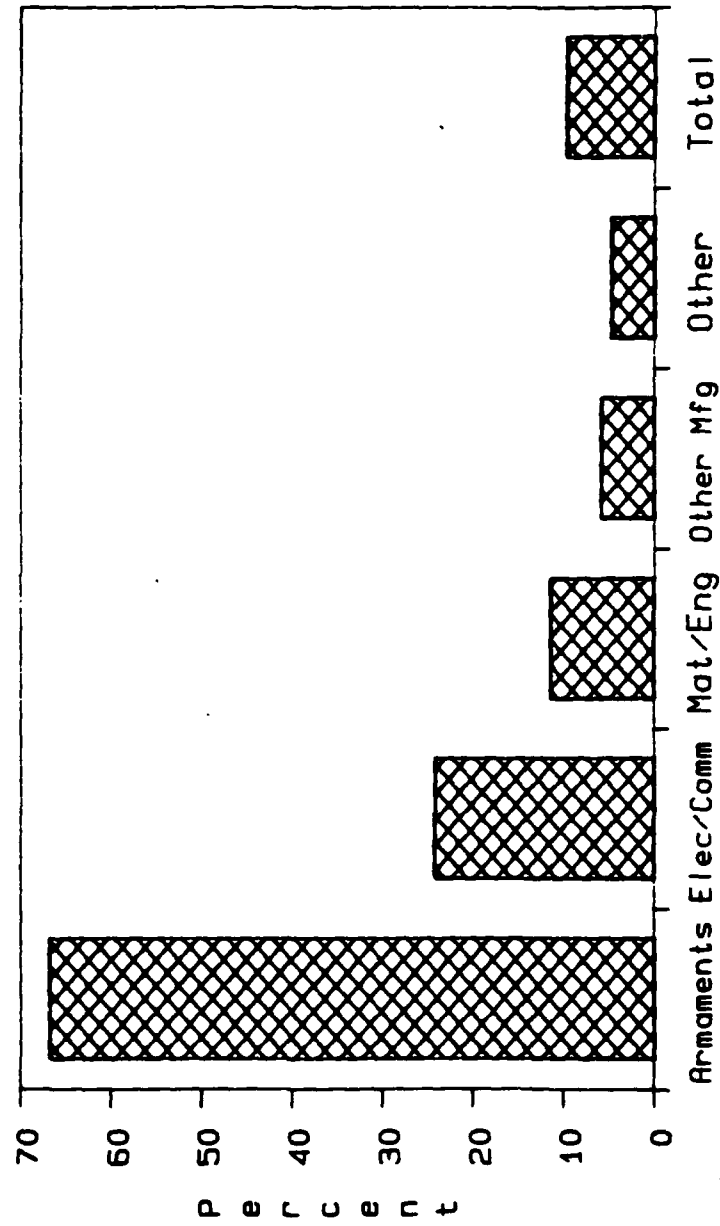
GROWTH 1983 TO 1989



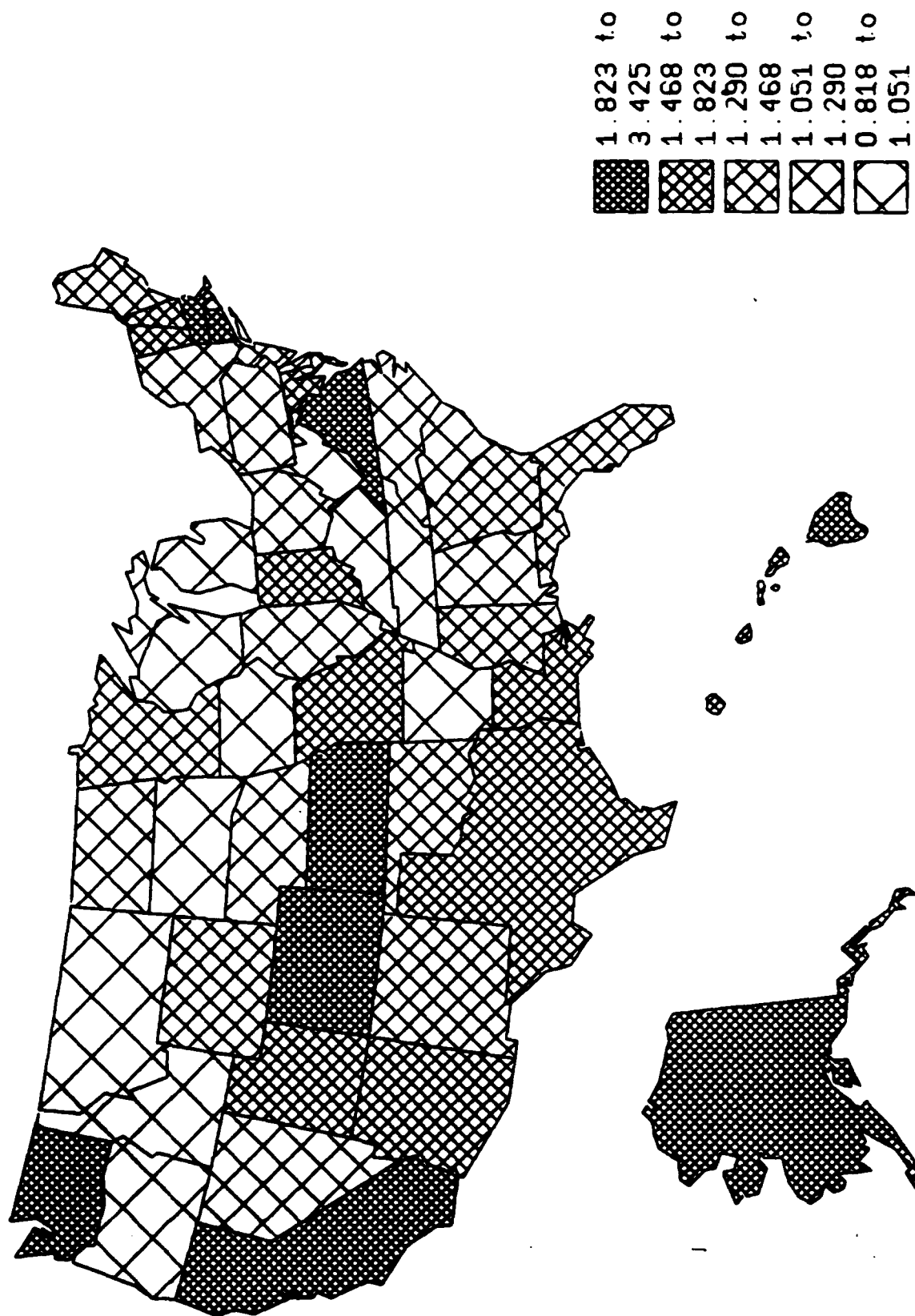
# CONTRIBUTION OF DEFENSE TO INDUSTRIAL GROWTH

BY PRIMARY INDUSTRIAL SUBAGGREGATES

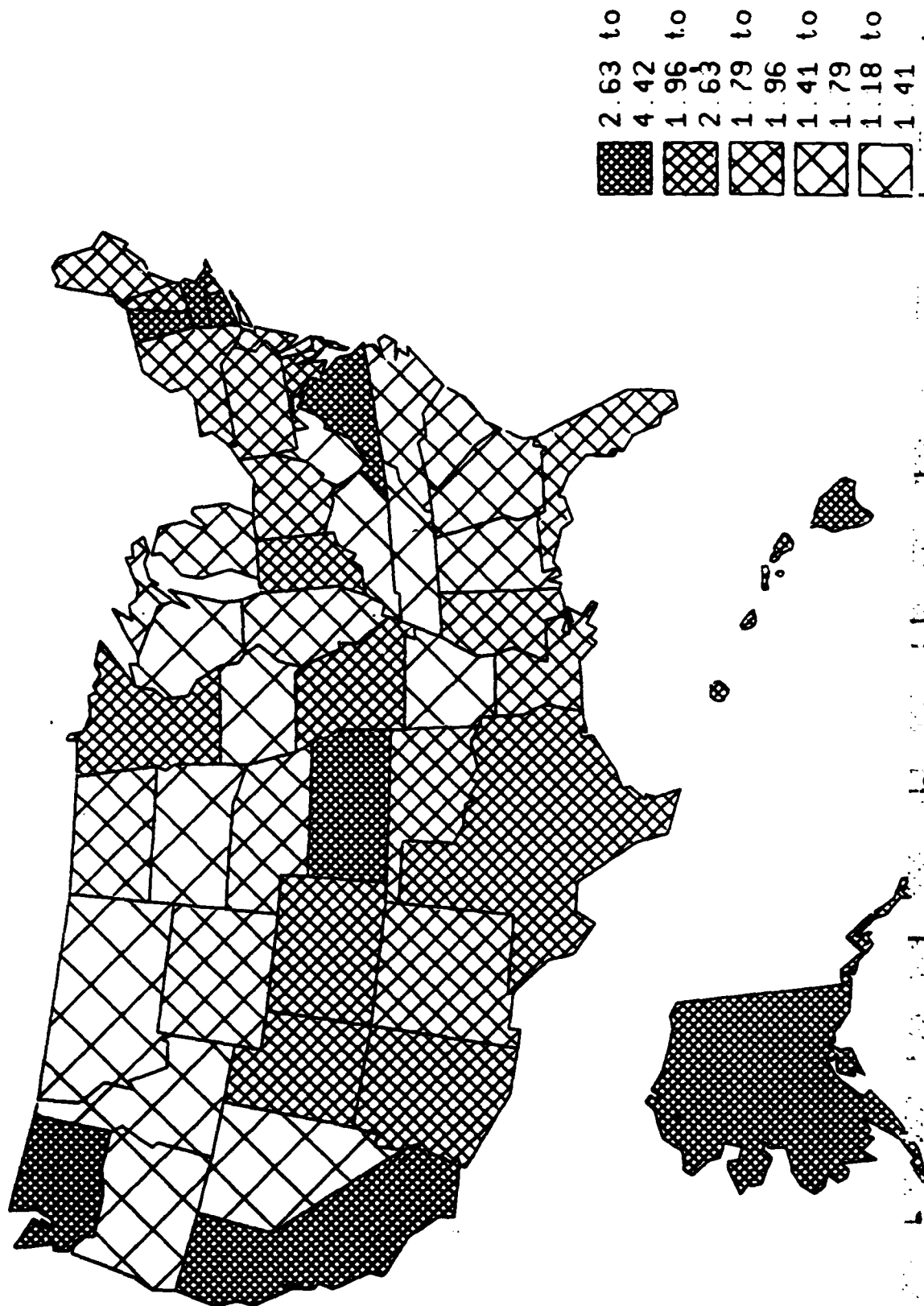
1983 TO 1989



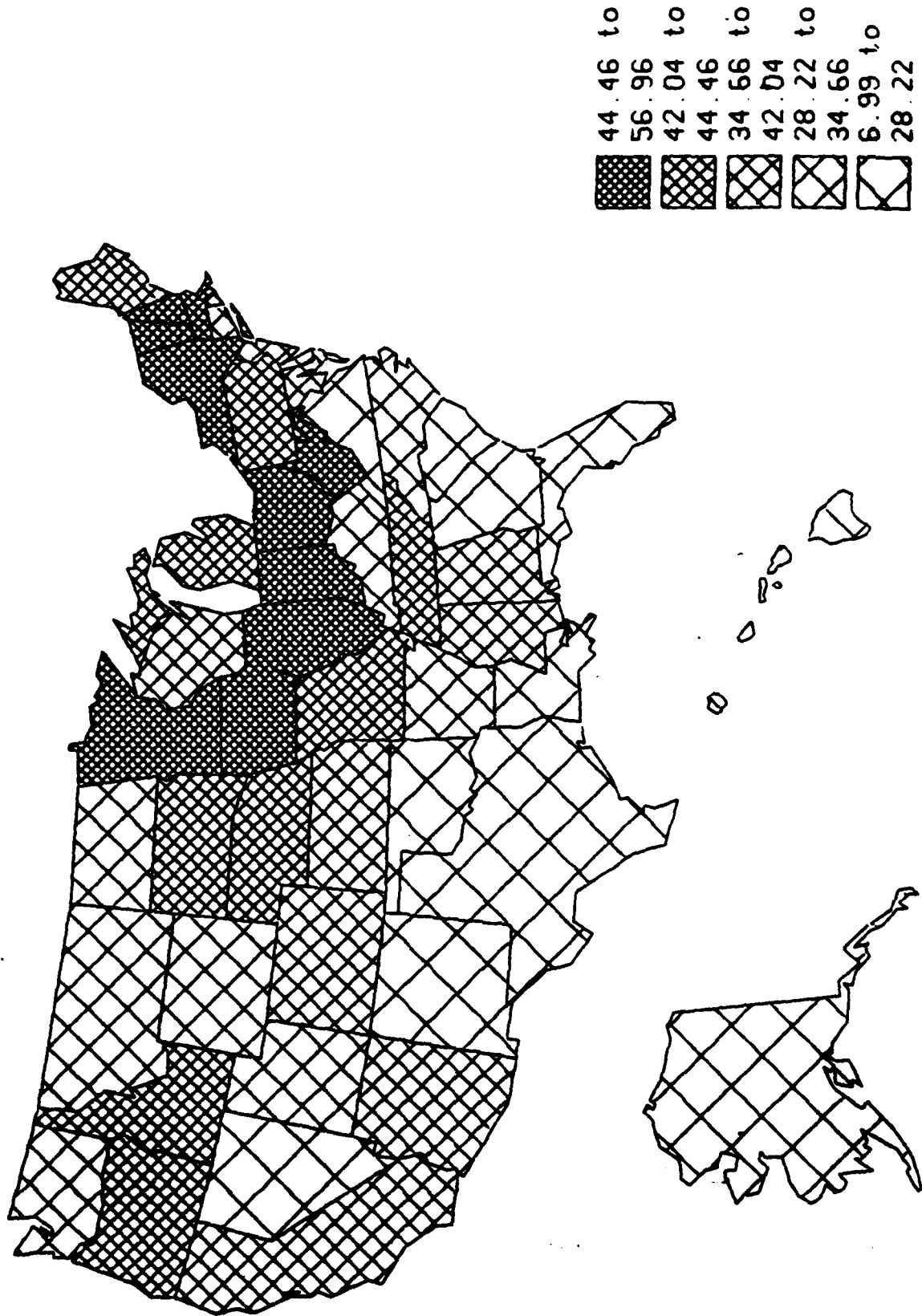
# ESTIMATED TOTAL DEFENSE EXPENDITURES PER CAPITA, 1983



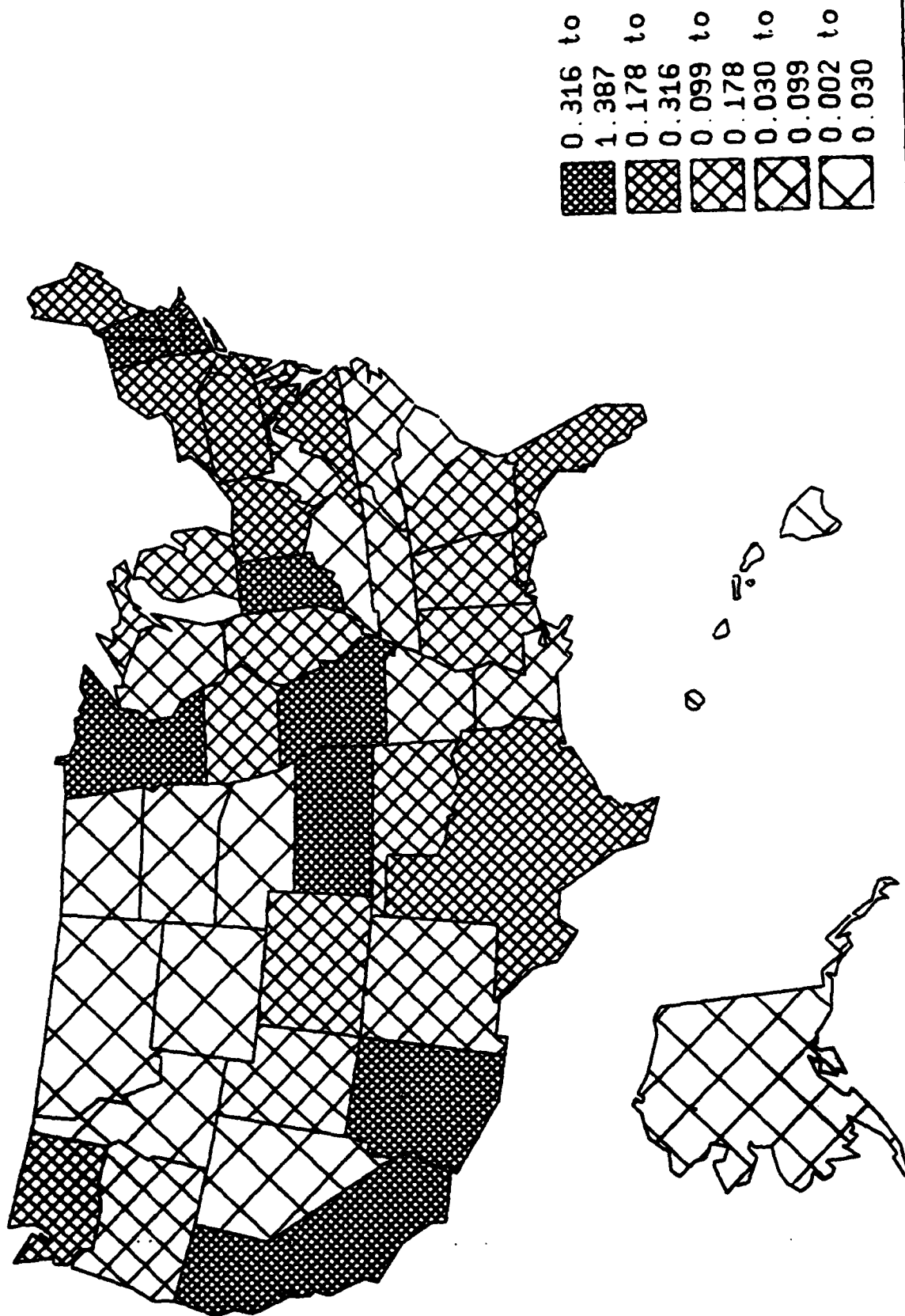
# ESTIMATED TOTAL DEFENSE EXPENDITURES PER CAPITA, 1989



# PERCENTAGE GROWTH IN PER CAPITA TOTAL DEFENSE 1983 TO 1989



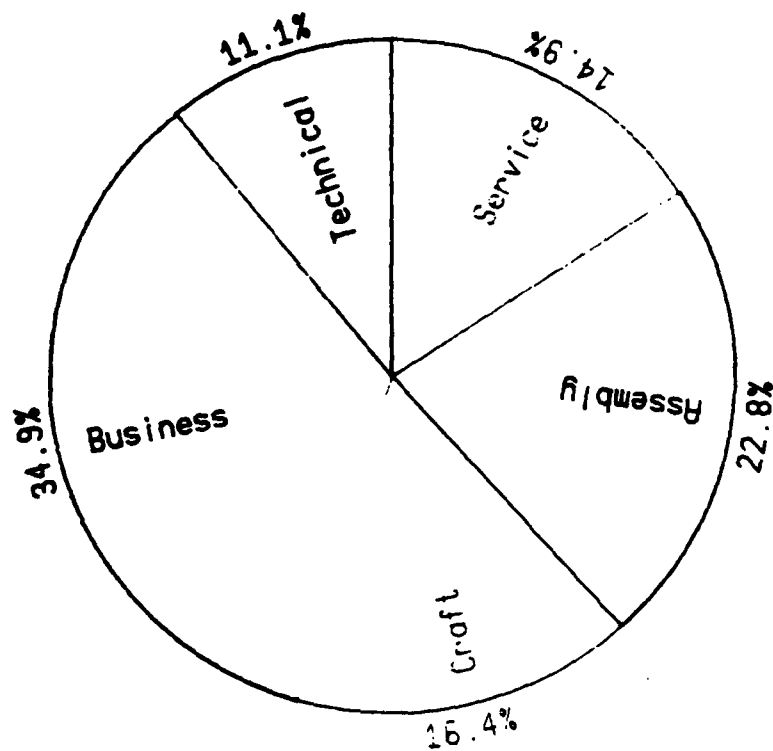
# ESTIMATED PROCUREMENT EXPENDITURES PER CAPITA, 1983



# SHARE OF DEFENSE EMPLOYMENT

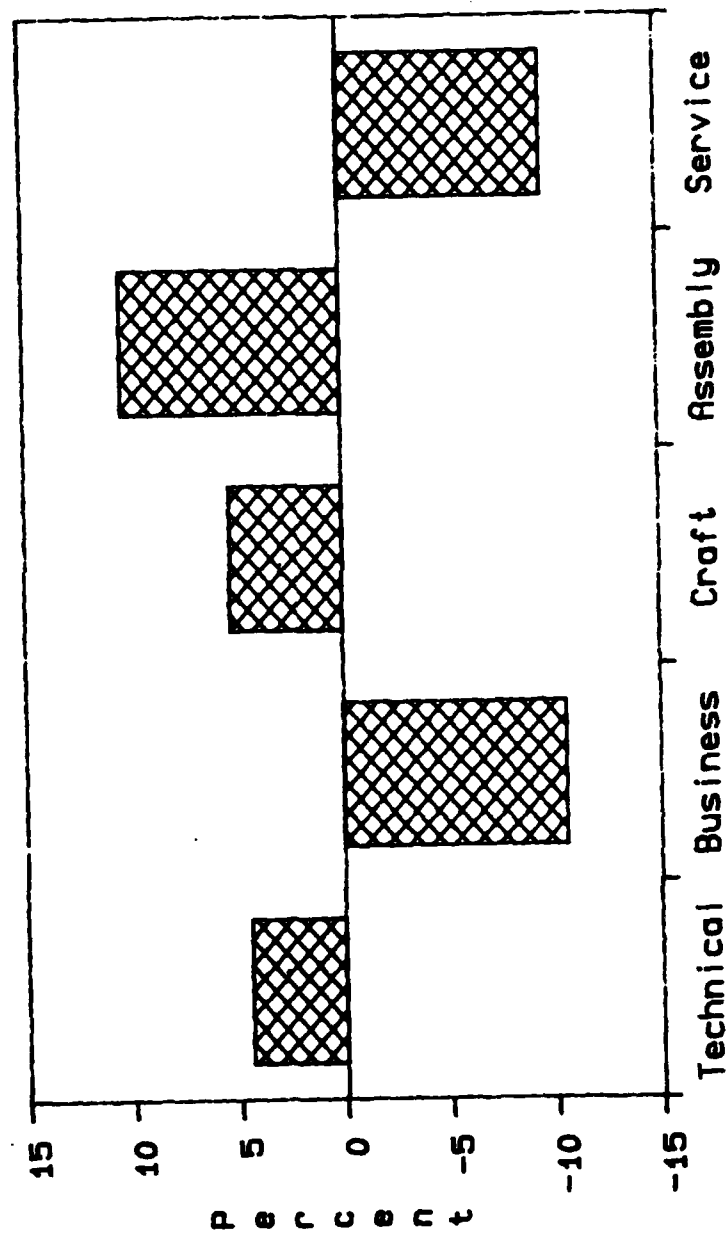
BY SKILLED LABOR AGGREGATES

1983



# DIFFERENCE IN EMPLOYMENT SHARES

DEFENSE VERSUS NON-DEFENSE  
BY SKILLED LABOR AGGREGATES, 1983

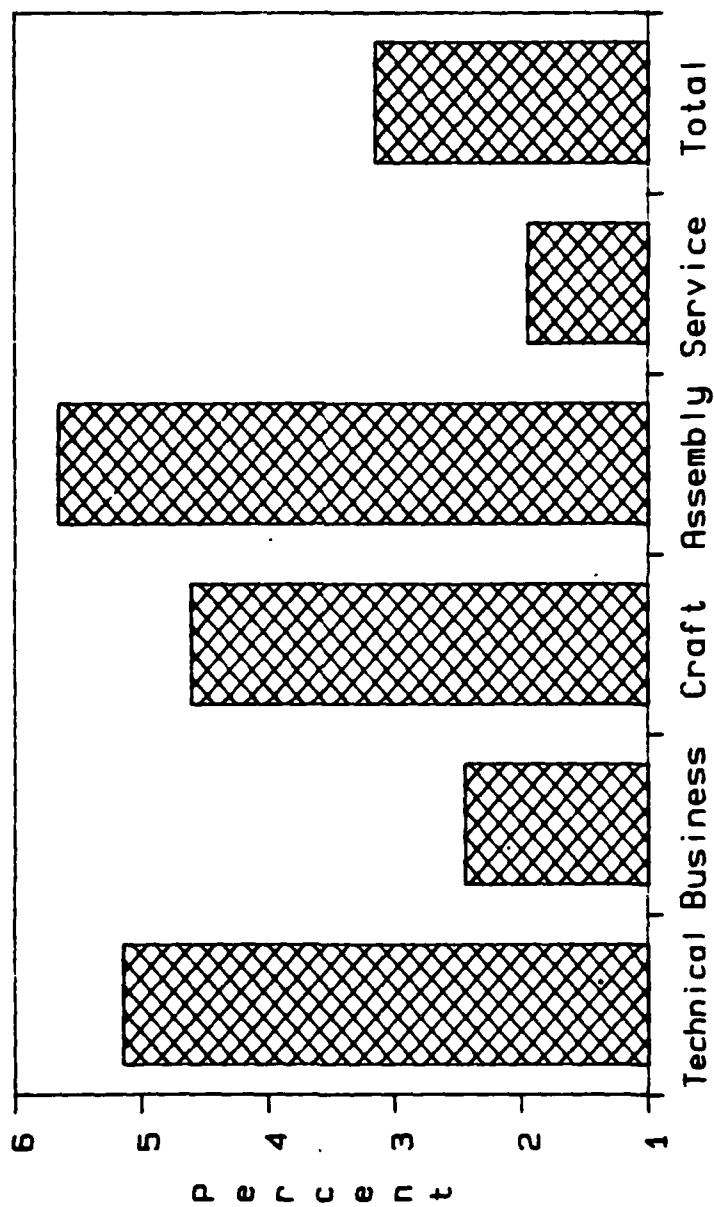




# DEFENSE SHARE OF SKILLED LABOR REQUIREMENTS

BY SKILLED LABOR AGGREGATES

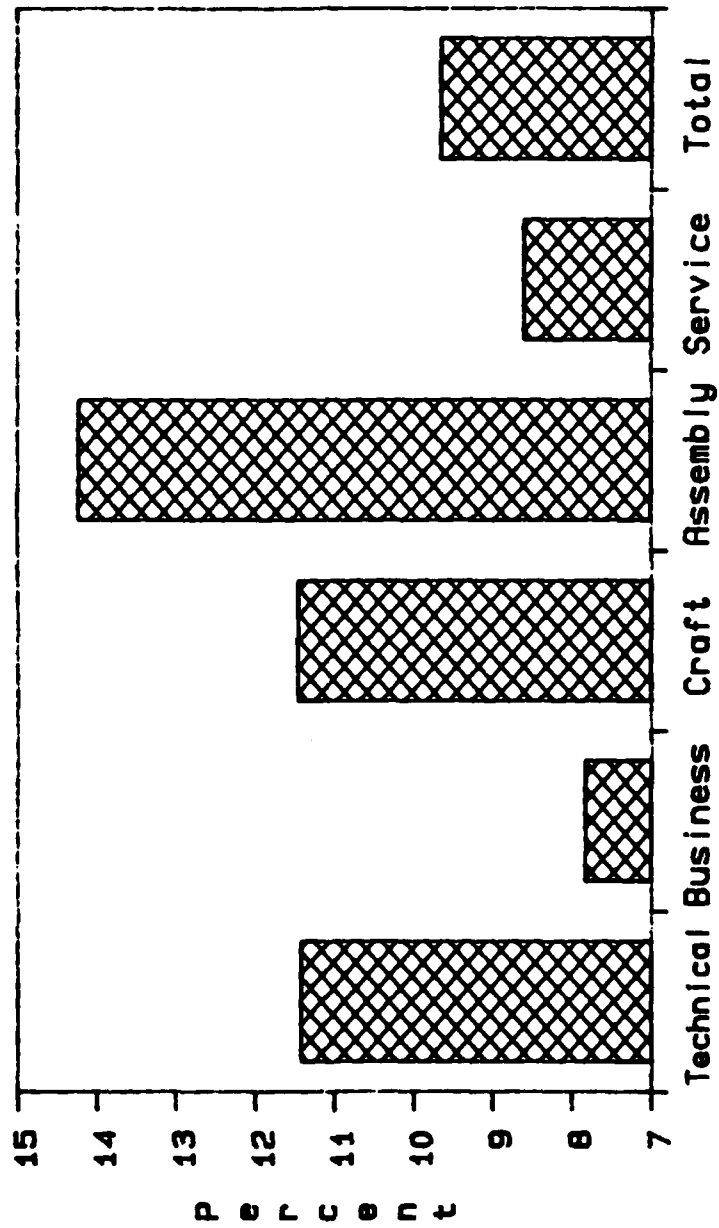
1983



# DEFENSE SHARE OF NEW EMPLOYMENT

BY SKILLED LABOR AGGREGATES

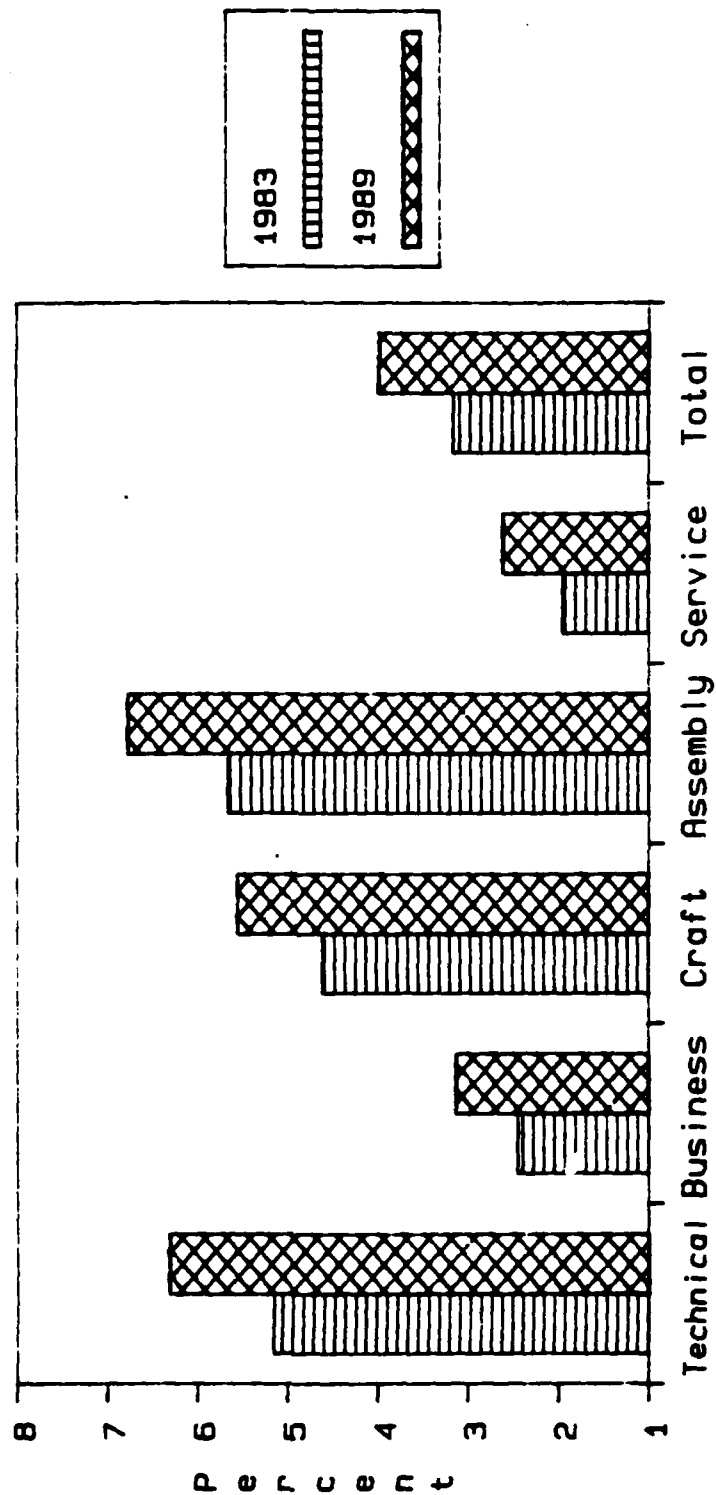
1983 TO 1989



# DEFENSE SHARE OF SKILLED LABOR REQUIREMENTS

BY SKILLED LABOR AGGREGATES

1983 and 1989



APPENDIX D

COMMENTS OF DR. DAVID S.C. CHU

What Do We Know -- And What Should We Know --  
About How Defense Spending Affects the U.S. Economy?

It is a great pleasure to join this panel, and to have the opportunity of discussing how defense spending affects the United States' economy. As DEIMS has evolved, it has proved to be a very useful tool in answering questions on this subject. What I would like to do is summarize what I believe the major issues have been, together with the profession's views on them, and then discuss the issues on which I would urge we concentrate our attention in the future, as we refine DEIMS and develop similar models.

As I view the debate, there have been at least six issues that--loosely speaking--might be called "macroeconomic."

First among these has been the deficit. There has been much discussion of how reductions in defense spending might lower the deficit. We estimate that a one-dollar reduction in defense outlays--from a cross section of the defense budget--yields (approximately) a 50-cent reduction in the first-year deficit. At the same time, a one-dollar reduction in first-year outlays could require as much as four dollars in budget authority cuts. These basic facts underlie the Department's position that the defense budget should not be viewed as a macroeconomic tool. Cutting defense spending is an inefficient way to adjust federal expenditures in the short run. This conclusion is consistent with the profession's view that the deficit is governed not by the size of any one account, but by the size of the federal budget as a whole.

A second matter of concern has been the relationship between defense spending and inflation. This was of considerable interest in the late 1970s, and the Department of Defense sponsored a conference on the issue. The conference concluded that the increases being considered--in some cases, larger than those actually voted thus far--were not large enough to affect significantly the inflation performance of the United States economy. This merely reinforces, in a specific case, CBO Director Rudy Penner's argument that defense spending is not different from other forms of government purchases in its macroeconomic effects.

A third and more recent concern has been the relationship between defense spending and employment. We estimate that each billion dollars in outlays on defense purchases generates 35,000 jobs--about the same number as any other broad-based group of federal purchases would generate. The Congressional Budget Office has likewise concluded that the employment-generating effects of defense spending are no different from those of other federal purchases (although the absolute CBO figure is lower than ours--20,000 jobs per billion dollars of purchases). I believe that the profession at large--if only from a "first principles" approach--would agree with these conclusions. It is therefore frustrating that so much attention has been paid to the one group that does not agree: the Employment Research Associates!

A fourth concern--expressed several years ago--has been that defense spending might crowd out private investment. When interest rates were high, many argued that defense spending needed to be cut to help bring them down, as part of a general effort to reduce the deficit. I think we need to recall that the deficit is not the only determinant of interest rates in the United States economy. There are a host of other forces at work--perhaps most important, policies of the Federal Reserve Board (including its decisions deregulating the banking industry). Interest rates also depend on the supply of funds from abroad, the age of the nation's capital stock, expectations of future demand, and the age distribution of the country's population (among other factors affecting savings).

The "crowding out" concern is not borne out by recent experience. In the 1970s, when nonresidential fixed investment varied within a relatively narrow range of the gross national product (9.5 - 11.5%), defense spending fell from 8 percent of GNP to 4.9 percent. Earlier this year, when the President's FY 1985 budget was presented to the Congress, DRI forecast that, notwithstanding the projected rise in defense spending to 7.5 percent of GNP in future years, nonresidential fixed investment would range from 10.8 to 12.3 percent of GNP--at the upper end of, and perhaps exceeding, the range in the 1970s. In fact, using DRI's models, we conclude that if DoD outlays were cut, nonresidential fixed investment would actually fall.

A fifth concern in the debate over the relationship between defense spending and the economy has been the effect of the defense buildup on economic growth. This concern was recently raised again by Representative Aspin, using a series of cross-country comparisons. Unfortunately, these overlook countries such as South Korea and Taiwan, which have experienced high rates of economic growth and have large defense budgets. Moreover, if defense increases have an adverse effect on growth, why in the 1970s, when defense spending was falling, did the rate of productivity growth also decline?

Rudy Penner has testified that he doubts there is any significant long run effect of defense spending on the rate of growth of the nation's economy. This is one issue on which the profession's understanding of causal effects is limited.

A sixth concern in the debate over defense spending has been its geographic distribution. An earlier presentation this morning confirmed some portions of that concern, but challenged others.

So much for the issues that might be called "macroeconomic" in character. What about microeconomic issues?

In fact, as I view the debate, there has been wide spread interest in only one microeconomic issue: bottlenecks. In considering this question, it is useful to recall that defense demands--direct and indirect--account for less than 3 percent of sales for three-quarters of U.S. Industries. It is true that about half of defense and defense-related expenditures are concentrated in 35 industries. But these industries are projected to account for less than 5 percent of U.S. output in the late 1980s.

Even for these industries, we do not expect any problems for the foreseeable future. The Department of Commerce recently completed a major study of the 58 industries projected to lead in defense and defense-related sales through 1985, that study, which used a higher GNP figure than the Administration forecast in January, concluded that existing capacity should be adequate in each of those sectors--a finding with which the Congressional Budget Office largely concurs.

What future issues should be of concern to us? As my remarks imply, the macroeconomic list of concerns has been long, and the microeconomic list rather short. The debate has largely focused on issues relating to whether there should be a defense buildup, and much less on how we should manage it (the microeconomic issues).

But the Congress has already answered the "whether" question in voting a 40 percent increase in real budget authority for defense since 1980. Perhaps it is time for the profession to focus on the "how" questions. What might those be?

I would nominate five for consideration.

First is the industrial organization of defense. An important element of this issue is competition. Defense goods are unlike many commodities, for which continuous competition is feasible. After initial bids are received for a defense product, how do we maintain competition? The size of our purchase may preclude making more than one award. This problem has been discussed in the literature as it relates to regulated industries, but not defense.

Another element in the industrial organization of defense is the industrial base: How do we decide what's "adequate"? How do we measure adequacy? By the number of firms engaged in defense business? By their capacity? Should we consider the United States alone or the free world as a whole? What roles should stockpiles play?

A third element in the industrial organization of defense involves research and procurement "ties" with our allies. There are great pressures to divide these more "fairly". What role should fairness play in such allocations? How should we account for comparative advantage?

A second microeconomic issue to which we might turn our attention is the problem of minimizing production costs. How can competition help hold down costs? Could particular types of contracts or provisions help? What role does stability play in minimizing production costs? Learning? The rate of production, given the scale of a plant?

A third microeconomic issue inviting our attention is the problem of warranties or guarantees. In principle, everyone is in favor of warranties. But how much should we be willing to pay for them? How enforceable are their provisions likely to be? Will firms respond to the Congress' desire for unlimited warranties, or will they seek to limit their liabilities in some fashion?

A fourth microeconomic issue on which we might focus is how best to provide the goods and services needed for defense. How much of this responsibility should be in the public sector? How much in private enterprises?

A fifth--but not necessarily final--issue with which we might be concerned is DoD's responsiveness to price changes: in other words, how does the economy affect defense? As manpower becomes more expensive, should we use more capital equipment? If so, how might that affect demand for more highly skilled personnel?

In closing, let me return to the main purpose of our conference--evaluating DEIMS and considering where we go from here. DEIMS has been extremely useful in the debate thus far. The new questions I've raised may be less suited to treatment by DEIMS, but it's proven extremely flexible, and will remain an important element in our analytic tool kit.



**APPENDIX E**

**SPEECH OF DEPUTY SECRETARY OF DEFENSE WILLIAM H. TAFT IV**

REMARKS BY SECRETARY TAFT  
TO THE  
CONFERENCE ON THE IMPACTS OF DEFENSE SPENDING  
8 MAY 1984

It is a pleasure to be here with you today to discuss the economic effects of defense spending. This has been the subject of active and sometimes heated debate in recent years, and I think it is safe to say that the debate over the effects of defense spending will be with us for some time.

At the outset, I would like to state clearly my own view that this debate, while not without importance, is truly a luxury that only a free society, well defended from its adversaries could devote a great deal of intellectual effort to. At times of immediate and evident national peril the subject is not worth discussing; moreover, the fact that our country is not in imminent danger is principally the result of the defense budgets of years past -- budgets that, whatever their economic effects may have been, have undoubtedly preserved peace and freedom for the United States and its allies, an economic treasure truly beyond price.

While the immediate topic of the debate about the economic effects of the defense budget has shifted several times in the past few years, generally emphasizing whatever aspect of economic performance happens to be most troublesome at the time, its broader focus has remained more constant, centering on three distinct questions:

- First, is the proposed defense program affordable; does it place acceptable demands on the nation's productive resources?

- Second, is the program producible; is there sufficient industrial capacity to manufacture the goods needed to meet defense requirements?
- And, third, is the program compatible with overall economic conditions; and specifically, to what extent should defense spending be used as an active tool of stabilization policy?

Let me begin with the question of affordability. At the current and anticipated levels of our defense program, there is simply no doubt at this point. The program is affordable.

The measure which we (and others) most commonly use to describe the resource burden of the defense budget is the share of gross national product that it claims. Some dismiss this as a simplistic measure. It is simple, but it is not simplistic. In trying to come to grips with the broad allocation issues presented by defense requirements, it is very much to the point to look at the share of economic activity devoted to defense. Of course, GNP shares cannot provide a simple formula for deciding how much we should invest in national defense. That decision requires careful judgments about the size and structure of our armed forces, informed by a long-run perspective on the availability of productive resources and the competing claims for their use, our military objectives, our commitments to our allies, and most importantly, the threats that we face. GNP enters this picture as a comprehensive, summary measure of economic resources available to the nation to meet a wide range of public and private demands.

Measured against GNP, the current defense buildup is neither large nor rapid. The defense outlays which the President has requested for Fiscal Year 1985 account for 6.8% of GNP. That figure is low by postwar standards -- that is,

excluding the 1970s, a decade in which defense needs were badly neglected. In 1955 -- and that was a boom year for the economy -- defense outlays accounted for 9.2% of GNP. Over the entire period from the close of the Korean War through the 1960s, defense outlays -- and I am speaking of baseline outlays, excluding the spending associated with the Vietnam War -- averaged 7.7% of GNP. That exceeds the highest share that defense will claim in any year of the current buildup. The period 1953-1969 was one of substantial economic growth for both the United States and the world economy, growth made possible it is fair to say in large part because of this country's military posture and the international stability that resulted from it. In this regard, it compares favorably with the decade that followed, a period when U.S. defense spending had lower priority with U.S. taxpayers, or at least with their representatives.

Some of those who argue that we are spending more than we can afford on defense bypass the question of resource allocation altogether. They assert that defense spending increases unemployment, by generating fewer jobs than other types of spending. This claim will not stand up to careful scrutiny; even if it were correct, it should still not be a dominant consideration in determining defense program levels.

Economists of varying backgrounds agree that all government purchases -- defense and nondefense alike -- have about the same effect on the employment. Every reputable study that we have seen on the subject, including recent reports issued by the Congressional Budget Office and a task force of the House Budget Committee, has reached the conclusion that defense and non-defense purchases by the Federal Government generate about the same number of jobs. That conclusion is confirmed by simulations that we have run using three of the leading private economic forecasting models.

Indeed, any other conclusion would be highly unusual, as the Congressional Budget Office has pointed out, many types of military expenditures have close civilian counterparts, and it would be surprising if Air Force runway construction created fewer jobs than road construction, or if military health benefits and retired pay had effects very different from those of medicare and Social Security.

Of course, it is possible to design a jobs program that creates more jobs than defense spending does. To grant this point significance, however, one has to assume that job creation not security, is the principal object of the defense budget. This is not the case.

Let me use an analogy to make my point. I think it is fairly clear that most federal spending on medical research does not do much to improve urban mass transportation. If we have money that we want to spend on mass transit, we would do better to use it to build subways, subsidize bus service, or on other directly relevant programs. If we choose instead to use that money to support medical research, that means that there are fewer resources available for other purposes, including urban mass transit. But I do not think that anyone would conclude from all this that medical research causes rush-hour traffic jams. Nor would anyone argue that the value of medical research is any way diminished by its short-comings as a mass transit program, or that those shortcomings should be counted against the benefits of medical progress when we decide how much to spend on medical research.

The situation is exactly the same for defense and employment. Even if it were true that defense spending, which pursues other goals, is surpassed as a generator of jobs by programs that are dedicated specifically to boosting employment, it would not mean that defense spending causes unemployment, or that we

should value national security any less than we do. All that it would mean is that we should not use the national defense budget as a jobs program. We should judge defense programs on their own merits, decide just how much we need to spend in order to preserve the peace, and not be distracted by factors that have only an indirect bearing on the issue.

My second question, closely related to the first, is whether the program is producible: is the industrial capacity in place that can produce defense goods in the quantities and on the delivery schedules that our program envisages? Or will there be bottlenecks that will frustrate our plans for rebuilding the nation's defenses?

About a third of DoD's outlays are for pay and pay-related expenses that are immune from bottlenecks: salaries of active military and civilian employees. Pension payments to retired military personnel, and other related costs.

Purchases of "off-the-shelf" items that are produced primarily for the civilian economy account for another quarter or so of DoD outlays. I do not think it is necessary to ask if this spending will lead to bottlenecks. Defense spending is too widely dispersed, and too small a fraction of sales for the industries involved, for there to be any real chance that the fractional increase in defense demands will strain production capacity.

If bottlenecks are a threat anywhere, we would expect to find them in the industries that produce specialized military goods -- fighter aircraft, tanks, missiles, ships, and so on -- and in the industries that produce specialized parts that go into those goods. Purchases of these items, along with research and development, account for the remaining two-fifths of the defense budget.

Even in these specialized defense industries, our purchases are widely spread, and this tends to minimize the risk of bottlenecks. Our analysis, which you saw in detail this morning, indicated that out of more than 400 U.S. industries, there are only about 25 for which defense and defense-related demands account for more than 20% of total sales.

Some of the best work that we have seen on this subject is contained in a study prepared by the Bureau of Industrial Economics at the Department of Commerce. That study examined the adequacy of industrial capacity to accommodate both the defense buildup and vigorous growth in the economy, and found "no instances where industry-wide supply bottlenecks are likely to prevent the achievement of our national defense goals". What is more striking, the study found that existing capacity alone will be sufficient to supply the projected demands of the economy in most of 58 key defense industries.

We have looked in even greater detail at several of the defense industries covered by the commerce study. We reviewed capacity in some important metals and metal-working industries; we went down through several tiers of the production in the aircraft industry; and we made plant-by-plant and product-by-product comparisons of purchases and capacity for several defense industries. What we have learned confirms the broad conclusion reached by the commerce study, and indicates that ample capacity is available to produce the defense program.

That leaves us with the last of my three questions: should we adjust the level of defense spending in response to the condition of the economy at any particular time? Should it be increased or decreased in order to stimulate employment or restrain inflation?

I strongly believe that it should not. Defense budgets are formulated in terms of the commitments we have made and

the threats we face, and those commitments and threats are relatively persistent features of the foreign policy landscape. Defense spending should therefore not be cut in response to transitory economic conditions. Doing so is relatively ineffective in its own terms; it generally increases defense costs; and it inevitably impairs our defense, even if only temporarily. It bears emphasis: just because Congress cuts defense programs to reduce the deficit, it does not follow that those programs are not needed to preserve peace in the world and freedom for our people.

Increasingly, we hear DoD's critics argue that defense spending must be cut in order to reduce the Federal deficit. We share their interest in reducing the Federal deficit, but we also know that even drastic cuts in our modernization program would not be a realistic or an effective means of doing so.

Part of the explanation of this point turns on the distinction between budget authority and outlays that Mr. Korb made this morning. Expenditures for major weapons systems are typically spread over many years. For example, less than one fifth of the cost of a naval ship is paid out during the first two years that it is under construction. Consequently, large cuts in procurement funding yield only relatively small reductions in current year outlays.

It is also important to recognize that a cut in defense spending does not appear one-for-one as a reduction in the Federal deficit. In fact, only about 50 cents of each dollar cut from defense outlays shows up as a reduction in the deficit. The rest is absorbed by reduced tax revenues and higher transfer payments, due to the cutback in the contribution of defense spending to GNP and employment.

Using cuts in major defense programs as an instrument of short-run economic policy also tends to increase the eventual cost of meeting our defense needs. When pressures are brought



to cut defense spending in response to short-run economic conditions, we are usually forced to postpone the start of new programs, or to stretch out existing ones. Stretching out a procurement means buying fewer units in each year, which almost always means higher unit costs. A postponement has a similar effect on development costs.

Finally, those who think that cuts in defense spending will improve the economic situation in the short run should consider the effect that this has on the industrial base. Defense industries tend to be the high-technology sectors of the economy. They also tend to be export sectors. Introducing instability into these industries does not help long-run economic growth.

Given the importance of procurement programs, their long planning horizons, and their relatively small short-run budgetary impacts, it is easy to understand -- although not to accept -- why attention turns to operations and maintenance. But O&M is an even more dangerous place to look for quick budget savings. The O&M accounts provide much of the readiness resources which keep the armed forces running. Cut O&M, and you end up with equipment grounded because of spare parts shortages, military units that lack fuel and ammunition for essential training, and military supplies that would be inadequate to sustain combat operations in the field.

These factors explain why it is hard to use the defense budget as an instrument of stabilization policy. I have a more fundamental point, though: hard or easy it is a bad idea. We try, to the best of our abilities, to make sure that every dollar in the defense budget is there because it is needed to maintain national security. That need does not ebb and flow with the business cycle; it is there all the time, and we ignore it at our peril. Likewise, increasing defense spending above what is necessary in order to stimulate the economy is undesirable policy.

We believe that what we have proposed is a prudent program, a program that has savings built into it, but a program that is absolutely essential if we are to maintain our strategic deterrent and have military support for the foreign policy that this nation wants. We believe that it is an affordable program, which can be carried out without unduly straining industrial capacity or threatening the health of the economy in any way.

That is not to say that our defense program does not impose costs, or that we will not be tempted from time to time to defer paying those costs while we deal with whatever happens to be the current crisis in economic policy. But I hope that we can all agree on the need to stick to a reasonable and steady defense program. That, indeed, is one of our most important long-term goals. Peaks and valleys in defense spending are as insidious to national security as they are to the health of the industrial enterprise that supports it. The defense of the United States must not be based on the ever-shifting ground of transitory economic concerns.

**APPENDIX F**

**WRITTEN REMARKS SUBMITTED BY PANELISTS**

Mr. Joseph V. Cartwright  
Dr. Lawrence R. Forest, Jr.  
Mr. David Henry  
Mr. Ronald Kutscher  
Dr. Karen Polenske



**UNITED STATES DEPARTMENT OF COMMERCE**  
**Bureau of Economic Analysis**  
Washington, D.C., 20230

June 5, 1984

Dr. R. William Thomas  
Institute for Defense Analyses  
1801 North Beauregard Street  
Alexandria, Virginia 22311

Dear Dr. Thomas:

Thank you for the opportunity to comment on the current state of DEIMS. I think the idea of holding formal conferences and solitciting comments on preliminary drafts is excellent, and will improve the accuracy and usefulness of DEIMS. May I suggest that establishing a semi-formal "DEIMS technical work group" to advise (not oversee) future research could be helpful?

I discussed the following seven points at the May 8 conference.

1. In the past year, I've read seven or eight documents that described DEIMS or regional DEIMS (RDEIMS)--including three of the newest documents which were only made available to me in the week before the conference. The newer documents are more readable; however, future panelists should have need more lead time to prepare for discussing DEIMS or RDEIMS. Also, please remember (a) that my comments and questions may be based on an inadequate understanding of DEIMS or RDEIMS, (b) but that I'm only claiming partial responsibility for my misunderstandings.
2. Two general comments on DEIMS:
  - (a) The DEIMS translator is necessary to "map" defense budget categories into industry-specific total requirements.\* But the translator is not a Keynesian aggregate-demand model.
  - (b) Why not a vector for each weapons system? This would permit incremental analysis. When the SecDef "trims" the budget, he calls for fewer of selected weapons systems.
3. Regional economics is confounding: it is disproportionately more difficult to estimate regional impacts.

---

\*More detailed comments on the DEIMS translator document are made below.

4. My comments on RDEIMS focused on procurement; although most would apply to the other six categories of the Defense budget in DEIMS. First, a general comment on the regionalization of national impacts in RDEIMS. Regional direct impacts are based on 1979-81 historical regional data aggregated for the 14 procurement accounts. Regional indirect impacts are estimated in two steps: (1) national indirect impacts are the difference of national total impacts and national direct impacts, and (2) national indirect impacts are spread to States based on State shares of national employment. RDEIMS can be categorized as "bottom-up" with respect to direct impacts and "top-down" with respect to indirect impacts. A similar approach was attempted by Roger Bezdek--see the Journal of Regional Science, 1975. Spreading of national indirect impacts (even with shares moved by a "shift-share" technique) can be contrasted with putting regionalized direct impacts into individual regional models (for example, RIMS II, MRIO, or NRIES II)--this would represent a purer "bottom-up" approach and conform more closely to "the state of the art," which is described in Adams and Glickman, Modeling the Multiregional Economic System, 1980.
5. Estimates of direct regional procurement impacts in RDEIMS suffer from three major potential problems:
  - (a) Directs are estimated by prime contract awards by State, yet the awards data I'm examining for the F-14 and M-1 extends far into what would be called indirects in private sector I-O terms. Are directs and indirects defined consistently in DEIMS and RDEIMS? Does it matter?
  - (b) For contract awards (regional directs in RDEIMS) the point of purchase may not be the place of performance, especially when a major portion of the prime contract award is "subcontracted."
  - (c) 14 categories of award may not be enough disaggregation for regional analysis. For example, is the 1979-81 historical mix of F-14's and F/A-18's the appropriate one for examining the regional impacts of the 1983-9 mix of naval fighter aircraft? The direct effects of the F-14 are felt in the East, while those of the F/A-18 appear to be spread throughout the nation. Wouldn't it be more accurate to use the projected mix to estimate direct regional impacts?
6. The "sharing-out" of national indirect procurement impacts is not an accurate technique. Many indirect impacts occur in the same States where the direct impacts occur--for example, purchased services, like transportation, utilities, bankings, etc. Also, some States may have large shares for material-producing industries whose national output is an indirect defense input, and yet make few shipments related to defense final demand--maybe screws in Michigan go into cars, not F-14's. Maybe material-producing defense subcontractors and indirect suppliers locate disproportionately near the recipients of prime contract awards.

The "sharing-out" of national indirect non-procurement impacts is also not an accurate technique. For example, military and retired

(M&R) pay generates an indirect demand for retail trade and local services, which are consumed where people live. For example, if Michigan received only 1 percent of national M&R pay, but had 5 percent of national retail trade employment, RDEIMS would assign Michigan 5 percent of the national indirect retail trade impacts of M&R pay to Michigan. The actual percentage would be lower.

In general, my hypothesis is that, according to the RDEIMS sharing-out algorithm for indirects, States receiving disproportionately large (small) shares of direct impacts get disproportionately small (large) shares of indirect impacts. The unfortunate consequence of this bias is that RDEIMS-estimated total defense impacts are, for example, too low in California and too high in Michigan. Is my hypothesis true? What is the size of this bias?

7. Three future research directions seem worthwhile:

- (a) do historical simulations--compare RDEIMS estimates with Census MA175 estimates ("Shipments of Defense Industries").
- (b) compare RDEIMS estimates with those generated by a purer "bottom up" approach.
- (c) do more system-specific coding and present some results at the system-specific level to illustrate implications of the RDEIMS algorithms.

My comments on DEIMS Translator (draft of April 26, 1984) follow:

Page

I-2

Remember that defense final demand, in NIPA-terms (National Income and Product Accounts) equals domestic value-added supplied to defense. Therefore direct sales to defense (\$200 billion in 1983) includes the flow of all valued added to support defense--excluding only consumer- and investment-induced flows. However, direct sales don't account adequately for industry-specific defense-related value-added flows; the I-O analysis is used to do that.

I-3

Defense outlays are passed to DRI's macromodel and to DEIMS. If the former is a Keynesian aggregate-demand model, while the latter is not, how can defense shares of total industry output, occupational requirements, etc. be specified? Am I missing something? Appendix A doesn't describe figure I-1 in enough detail to lessen my confusion.

II-1 to II-11

This chapter is a clear discussion of the translator. I wish I had read (maybe, had the time to read?) it more carefully before the May 8 conference. Two quick comments. One, the mathematical treatment (appendix B) to avoid double counting--missing from my draft copy--

would be helpful. Two, do the "automated subvectors" imply an ability to do out-year incremental analysis--more F-14, fewer F/A-18's in FY86 than in FY79-81? I think the answer is no?

III-4 to III-17, and V-1 to V-17

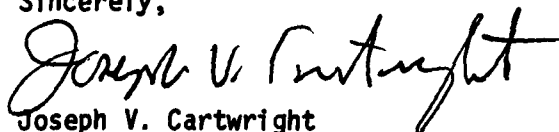
The industry allocations seem thorough and, for the most part, clear. Two brief questions? First, sometimes consumption-induced effects are estimated in DEIMS--for example, military personnel; sometimes not--for example, retired pay, and CFE employees; what's the reason? Second, military personnel, through their personal consumption expenditures, indirectly generate a requirement for retail trade employment; yet don't many of these expenditures occur at onbase facilities staffed by nonappropriated fund personnel and base-operating-staff personnel, who are accounted for directly elsewhere? Double counting?

IV-1 to IV-185

The use of subaccounts (elsewhere referred to as subvectors) for individual weapons systems is important. However, are the industrial allocations for F-14's and F/A-18's really the same? Since our work at BEA is focused currently on the regional and industrial impacts of the F-14 and M-1 tank, I'm unhappy (happy) that the industrial allocations for the F-14 (M-1) aren't (are) shown by themselves. The detail in this chapter is too abundant for me to discuss, except for "the industry allocations seem through and clear".

I hope we will have the opportunity to discuss my comments in the near future.

Sincerely,

  
Joseph V. Cartwright  
Regional Economist  
Regional Economic Analysis Division

cc: Dr. John Lynch

Comments on DEIMS' GNP and Industry Forecasts  
by Lawrence R. Forest, Jr.

The Defense Expenditure Impact Modeling System (DEIMS) combines detailed information on defense purchases with DRI's trendlong forecast for nondefense to yield five-year projections of defense- and nondefense-generated output in the total economy and in more than 400 industries. DEIMS uses internal DoD data in projecting defense-generated output by industry. These projections using novel information should help firms better foresee pending defense business. DEIMS would be even more helpful to business planners if it included measures of forecast uncertainty and if it sorted industries into groups demanding larger and smaller resource endowments.

DEIMS Translator

DEIMS projects defense production by industries based on the Five Year Defense Program (FYDP), detailed translators converting defense-budget dollars into final purchases from industries, and DRI's estimates of the input-output structure of the U.S. economy. The translators, which are unique to DEIMS, allow more accurate forecasting of defense requirements.

The translators surely could be improved in many details and need regular updating. But I don't believe that much additional effort on refining the translators would improve DEIMS markedly. To make major upgrades, one must focus elsewhere.

Uncertainty

One could make DEIMS much more useful to business planners by including measures of forecast uncertainty alongside the point estimates of future output. The out-of-sample forecasting performance of DEIMS in historical simulations would provide perhaps the best measures of uncertainty. Alternatively, one could measure the accuracy of past forecasts of final-demand components and use this to gauge the uncertainty in forecasts of industry output. As DEIMS now stands, the absence of measures of uncertainty invites skepticism by users.

Growing and Shrinking Sectors

To send clearer signals to business planners, DEIMS needs to sort sectors into groups demanding larger and smaller resource endowments.



DEIMS now gives output forecasts in constant dollars, but these may be hard to relate to business plans. For one thing, constant dollars is an abstract concept that may not be well understood by businessmen. More important, constant-dollar growth bears a tenuous relationship to resource requirements. For example, a 10 percent annual growth rate in the semi-conductor industry may well portend shrinking employment and investment, whereas in the aluminum industry, it would signal a need for massive investment in new capacity.

One sorting method that I have used in my own research estimates future capacity on the basis of an industry's trend growth path. Those industries for which projected output exceeds 1 standard deviation above trend are identified as "possible bottlenecks in the absence of accelerating investment." Two ideas motivate this method: (1) the rational firm would invest to maintain capacity in balance with expected output, which might be estimated by trend output; and (2) unusually high output, measured as more than one standard deviation above normal output, signals the need for accelerated investment in new capacity. This method adjusts for differences in (productivity) trends across industries and can be applied cheaply and with limited judgmental oversight.

#### Summary

DoD's DEIMS model allows businesses to better foresee future defense-production requirements. The model needs to provide measures of forecast uncertainty and to sort industries into growing and declining sectors.



**UNITED STATES DEPARTMENT OF COMMERCE**  
**The Under Secretary for Economic Affairs**  
Washington, D.C. 20230

May 23, 1984

**DRAFT**

Dr. Bill Thomas  
Institute for Defense Analysis  
Alexandria, Virginia 22311

Dear Bill,

Thank you for the opportunity to review the DEIMS documentation. My comments on the documentation are enclosed (Enclosure 1). Furthermore, some points that I raised at the DEIMS conference are listed below.

Comments

- o The process of unbundling major weapon systems into a first order bill of goods is a good way to implicitly revise Input-Output coefficients to reflect military specific or current technology in inter-industry transactions. However, unless compensatory adjustments are made, the output of the industry producing the major weapon system can be underestimated. Also, first order inputs are final demands in the DEIMS system. Output of these first order inputs are also generated by the major weapon system. Unless done carefully, this tends to overestimate output. For instance, comparing the DEIMS output and Census data on shipments to Federal Government agencies in 1982, (Enclosure 2), DEIMS underestimated aircraft (SIC 3721) by 16 percent and overestimated engines (SIC 3724, -64) and equipment (SIC 3728, -69) by 7 and 29 percent, respectively.
- o One way to avoid the problem of underestimating major weapon systems and possibly double counting of components is to completely unbundle procurement categories. That is, the air frame assembly should be unbundled and set up as an independent vector in final demand. There would be no need to recast the I-O table since there is very little sale of aircraft to the processing sector. Thus, moving the aircraft industry to final demand will not cause understatement due to lack of feedback. BLS treats construction in this manner
- o To my knowledge, there has been no attempt to validate the outputs generated by the DEIMS Translators. The comparison to Census shipments data could be one method to validate the DEIMS outputs.

**DRAFT**

AD-A146 090

EVALUATION OF THE DEIMS (DEFENSE ECONOMIC IMPACT  
MODELING SYSTEM) SYSTEM(U) INSTITUTE FOR DEFENSE  
ANALYSES ALEXANDRIA VA R W THOMAS JUL 84 IDA-D-67  
IDA/HQ-84-28880 MDA903-84-C-0031

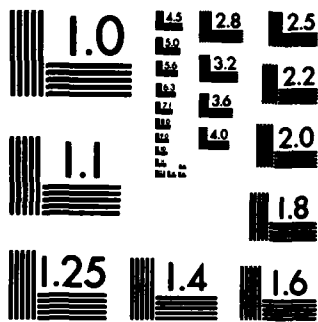
2/2

UNCLASSIFIED

F/G 5/3

NL





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

# DRAFT

- o DEIMS' generated procurement data should be consistent with National Accounting definitions since (1) the DRI macro model and (2) the DRI Input-Output matrix are both consistent with the National Accounts.
- o DEIMS estimates investment for major weapon systems by distributing a portion of the buy to capital equipment, particularly metalworking machinery. Therefore, this investment shows up as a Federal Government purchase. This is O.K. except that (1) a better distribution is needed to structures and equipment, and (2) this method results in double-counting investment requirements unless the fixed private business investment component of GNP is adjusted accordingly.
- o DEIMS is a demand driven model unconstrained by capacity.  
, Available supply needs to be evaluated along with estimates of requirements.
- o DEIMS does not account for non-DOD defense purchases as a part of National Defense. This represents 2-3 percent of National Defense expenditures, including nuclear warhead purchases.
- o DEIMS estimates strategic material requirements using a three year fixed average of materials consumption data. The method should be evaluated, perhaps adopting the method recommended by the EMPB in the Stockpile Review.
- o The O&M accounts need to be updated.

## Recommendations

- o Automatically accepting as a given the industrial output requirements projected by DEIMS is not acceptable to me, and perhaps economists and technocrats in other agencies. I recommend that DOD chair an interagency panel to review the results and to validate the procedures and data used in the DEIMS model.
- o If the DEIMS model is to generate official DOD estimates, I recommend that other DOD offices, particularly the Comptroller and Office of Industrial Preparedness participate in validating and sanctioning the DEIMS model, if appropriate.
- o Security precautions to protect the classified nature of the source data in the FYDP and other budget documents has not been addressed. Determination should be made as to what point in the calculations the data are declassified by appropriate security officials in DOD.

DRAFT

**DRAFT**

In summary, I feel the DEIMS translators to be the best yet available. However, work still needs to be done to improve the translators. I will be happy to talk to you or P.A.&E. about my comments.

Sincerely,

David Henry  
Regulatory & Legislative Analysis  
Division, Room H4510  
Office of Business Analysis

Enclosures

**DRAFT**

Enclosure 1

Page II-2, 1st paragraph

The Commerce version of the translator was revised substantially to reflect DOD's changes in the Procurement and R.D.T.&E. accounts. These changes were made in 1982. Since then, no revisions have been made in the Commerce translators.

Page II-6, 3rd paragraph

This paragraph implies that Commerce used only the basic 1972 table which was not the case. Commerce, in its 1979-85 study, used the 1972 table calibrated to 1979 outputs, thus an updated table. Commerce also reviewed the input coefficients of 58 industries determined to be defense intensive. Where "specialized" coefficient adjustments were deemed necessary, they were made and the I-O table reinverted. These adjustments were made by BIE industry specialists whose industry insight reflect the current technology of the industry. Also, the energy rows in the I-O table were adjusted (rowscaled) to reflect energy use after the oil crisis.

Also, this paragraph implies that Commerce does not use a commodity base table. Commerce does use a commodity-by-commodity base I-O table in its analysis.

Page II-10, last paragraph

See first three comments of letter.

Page III-4, 1st paragraph

Food furnished the military and standard clothing issued to military personnel are treated as personal consumption expenditures in the National Accounts and are included in pay (in kind) of government employees.

**DRAFT**

DRAFT

Enclosure 2

A Comparison of National Defense Final Demands  
Census 1/ vs. DEIMS, 1982  
(millions of 1972 \$)

<u>SIC</u>	<u>Industry</u>	<u>Census 1/</u>	<u>DEIMS</u>	<u>Ratio 2/</u>
3482	Small Arms Ammo	186.2	212.0	1.14
3483	Ammo, Exc. Small	507.7	979.0	1.93
3484	Small Arms	91.5	25.0	.27
3489	Ordnance, nec.	254.1	582.0	2.29
281,286	Chemicals	26.0	671.0	25.81
2892	Explosives	78.3	126.0	1.61
2919	Petroleum	511.1	647.0	1.27
3573	Computers <u>3/</u>	1,031.4	2,129.0	2.06
3825	Elec. Meas.	257.7	1,609.0	6.24
3662	Radio & TV Equip.	6,603.5	7,858.0	1.19
3721	Aircraft	4,699.7	3,950.0	.84
3724,64	Air & Missile Engines	1,456.1	1,558.0	1.90
3728,69	Air & Missile Equip.	1,076.6	1,390.0	1.29
3761	Missiles	2,402.6	1,715.0	.71
3731	Shipbuilding	2,201.6	3,459.0	1.12
3795	Tanks	593.4	307	.57
3811	Eng. Inst's <u>3/</u>	65.2	588.0	9.02
3823,24	Cont. Inst's <u>3/</u>	39.4	657.0	16.67

1/ Census Report MA-175 - Shipments to Federal Government Agencies, 1982.

2/ DEIMS to Census Ratio.

3/ Large differences probably due to definition. Census shipments are treated as a final demand, whereas DEIMS unbundling practice changes an indirect demand into a direct final demand.

DRAFT



FORECASTING THE IMPACT OF DEFENSE SPENDING  
MAY 8, 1984  
WASHINGTON, D.C.

I. REVIEW OF DEFENSE SPENDING ON ECONOMY

A. CANNOT REVIEW NUMBERS

B. WILL REVIEW MODELLING APPROACH

C. HOW IMPORTANT A PROBLEM ARE ERRORS.

1. HOW WILL DATA BE USED IN DECISION-MAKING

2. SINCE DEFENSE IS A SMALL SHARE OF GNP, SMALL CHANGES CAN  
LEAD TO LARGE ERROR IN SHARE ESTIMATES.

3. IF WE ONLY NEED TO KNOW DIRECTION AND ORDER OF MAGNITUDES  
THEN ERROR PROCESS IS DIFFERENT.

II. WHAT IS GOOD ABOUT MODELLING APPROACH

A. DETAILED I-O BY INDUSTRY

B. DETAILED BREAKDOWN OF DEFENSE PURCHASES

C. SIMULATION CAN BE BEGINNING OF HIGHLY USEFUL ANALYSIS.  
HOWEVER, IN AND OF THEMSELVES MUST BE USED CAREFULLY BECAUSE:

III. SHARES PROBLEMS COMMON TO ALL FORECASTING MODELS BUT NEED NOT EXAMINE HERE.

IV. WHAT ARE TROUBLING PROBLEMS ABOUT THIS APPROACH

- A. DISAGGREGATES DEFENSE VECTOR BEYOND DATA AVAILABILITY.
- B. ASSUMES NO DISTINCTION BETWEEN PRODUCTION FOR DEFENSE AND NONDEFENSE AND THAT THEY ARE SUBSTITUTABLE.
- C. ISN'T CLEAR HOW EMPLOYMENT REQUIREMENTS ARE DETERMINED--BLS EXPERIENCE HAS BEEN FOR THIS TO BE THE MOST IMPORTANT AND MOST TROUBLING TO FORECAST.
- D. HOW IS TECHNOLOGICAL CHANGE INCORPORATED.
  - 1. SINCE DEFENSE IS ON THE CUTTING EDGE OF TECHNOLOGY THAT CAN BE AN IMPORTANT FACTOR IN THE SECTORS WHICH THEY ARE DOMINANT.
- E. GROWTH IN DEMAND FOR LABOR ONLY A BEGINNING POINT.
  - 1. MOBILITY ONE ELEMENT IN SUPPLY VARIES BY AN ORDER OF MAGNITUDE OF 50 AMONG OCCUPATIONS.
- F. NO QUALIFICATIONS APPEAR AS IF DATA ARE INFALLIBLE, DOCUMENTS SAY DATA CHECK BUT NO REFERENCES AS TO HOW THAT IS DONE.

V. MODEL RUNS SHOULD NOT BE THE END OF THE PROCESS BUT THE BEGINNING

A. BLS PROCEDURE FOLLOWS SAME MODEL SEQUENCE.

1. LABOR FORCE
2. ECONOMIC MODEL
3. INPUT-OUTPUT MODEL
4. LABOR DEMAND MODEL
5. INDUSTRY OCCUPATION MODEL
6. DETERMINATION OF JOB OPENINGS

B. MANY MODEL RUNS ALL INTENSIVELY EVALUATED AND THEN RERUN.

C. EVALUATE AND PUBLISH RESULTS FOR BOTH AND USERS TO SEE ACCURACY.

Table 1. U.S. MULTIREGIONAL INPUT-OUTPUT, MICROSIMULATION, AND ECONOMETRIC MODELS

Model	Acronym	Developed by	Developed at
<u>Multiregional Input-Output</u>			
1. Impact Planning	IMPLAN	Lofting and Alward (1980)	U.S. Forest Service, Department of Interior
2. Income Determination Input-Output Model	IDION	Dresch (1980)	Institute for Demographic and Economic Studies, New Haven, Connecticut
3. Multiregional Input-Output	MRIO	Polenske (1970, 1980)	Massachusetts Institute of Technology, Cambridge, Massachusetts
4. Multiregional Input-Output	MRIO	Jack Faucett Associates, Inc. (1982)	Chevy Chase, Maryland
5. Regional Industrial Multiplier System	RIMS	Ronald Drake (1977)	Bureau of Economic Analysis, U.S. Department of Commerce
6. Regional Input-Output Modeling System II	RIMS II	Cartwright, Beemiller, and Gustely (1981)	Bureau of Economic Analysis, U.S. Department of Commerce
7. Regional Purchase Coefficient	RPC	Stevens, Treyz, and others (1980b)	Regional Science Research Institute, Amherst, Massachusetts
8. Regional Purchase Coefficient	RPC	Stevens (1983)	Regional Science Research Institute, Amherst, Massachusetts

Table 1. U.S. MULTIREGIONAL INPUT-OUTPUT, MICROSIMULATION, AND ECONOMETRIC MODELS (continued)

Model	Acronym	Developed by	Developed at
<u>Multiregional Input-Output</u>			
9. Multiregional Policy Impact Simulation	MRPIS	Social Welfare Research Institute (1982)	Boston College, Chestnut Hill, Massachusetts
10. Regional, Sector, and Income Distribution	RESIND	Golladay and Haveman (1977)	Poverty Institute, University of Wisconsin, Madison, Wisconsin
<u>Multiregional Econometric Models</u>			
11. Multiregional Forecasting and Simulation Model	MULTIREGION	Olsen (1976)	Oakridge National Laboratory, Oakridge, Tennessee
12. Multiregional, Multi-Industry Forecasting Model	MRFMI	Harris (1970)	University of Maryland, College Park, Maryland
13. National-Regional Impact Evaluation System	NRIES	Pallard and Wendling (1978)	Bureau of Economic Analysis, U.S. Department of Commerce
14. Regional Input-Output Modeling System II, combined with National-Regional Impact Evaluation System	RIMS II/ NRIES	Kort and Cartwright (1981)	Bureau of Economic Analysis, U.S. Department of Commerce

Table 1. U.S. MULTIREGIONAL INPUT-OUTPUT, MICROSIMULATION, AND ECONOMETRIC MODELS (concluded)

Model	Acronym	Developed by	Developed at
<u>Multiregional Econometric Models (cont'd.)</u>			
15. Regional Economic Forecasting and Simulation	REFS	Treyz and Ehrlich (1982)	Regional Economic Models, Inc. Amherst, Massachusetts
16. Top-Down Multiregional Econometric Model	TD	Milne, Adams, and Glickman (1980)	University of Pennsylvania, Philadelphia, Pennsylvania
17. Wharton Econometric Forecasting Associates Multiregional	WEFA	Fromm, Loxley, and McCarthy (1980)	Wharton Econometric Forecasting Associates, Philadelphia, Pennsylvania

prepared by:

Dr. Karen Polenske  
Dept. of Urban Planning  
Massachusetts Institute of Technology

DISTRIBUTION  
IDA RECORD DOCUMENT D-67

EVALUATION OF THE DEIMS SYSTEM

85 Copies

Copies

**DEPARTMENT OF DEFENSE**

Office of the Secretary of Defense  
Room 3A948, The Pentagon  
Washington, DC 20301

ATTN: Mr. William H. Taft, IV  
Deputy Secretary of Defense

1

Office of the Secretary of Defense  
Assistant Secretary (Manpower, Installation,  
and Logistics)  
Room 3E813, The Pentagon  
Washington, DC 20301

ATTN: Dr. Lawrence J. Korb  
Mr. Charles Groover  
Mr. John C. F. Tillson  
Mr. Robert M. Rauner, Director  
Office of Economic Adjustment  
Dr. John Lynch  
Office of Economic Adjustment

1

1

1

1

14

Office of the Secretary of Defense  
Director, Program Analysis and Evaluation  
Room 2E313, The Pentagon  
Washington, DC 20301

ATTN: Dr. David Chu  
Dr. David L. McNicol  
Dr. David L. Blond  
Mr. Paul Dickens

1

5

2

2

Office of the Secretary of Defense  
OUSDRE (DoD-IDA Management Office)  
1801 N. Beauregard Street  
Alexandria, VA 22213

ATTN: Col. T. L. Ricketts

1

Defense Technical Information Center  
Cameron Station  
Alexandria, VA 22314

12

Dist-1

**DEPARTMENT OF THE ARMY**

Commander  
U. S. Army Research Institute for the  
Behavioral and Social Sciences  
5001 Eisenhower Avenue  
Alexandria, VA 22333

ATTN: Mr. Hyder Lakhani

1

**OTHER GOVERNMENT AGENCIES**

U. S. Department of Commerce  
Washington, DC 20230

ATTN: Mr. Joe Ambargis  
Mr. David Henry

1

1

1

Dr. Donald S. Bell  
Northeast - Midwest Congressional Coalition  
House Office Building, Annex 2  
Room 530  
Washington, DC 20515

Mr. Glenn Coplon  
U. S. Department of Energy  
Forrestal Building, Room GI-216  
Washington, DC 20585

1

Dr. William Cox  
Congressional Research Service  
U. S. Congress  
101 Independence Avenue, S. W.  
Washington, DC 20559

1

Mr. Eugene M. Ebner  
Office of Management and Budget  
National Security Division  
Room 10001  
New Executive Office Building  
Washington, DC 20503

1

Mr. Alan Fechter  
National Academy of Sciences  
2101 Constitution Avenue, N. W.  
Washington, DC 20418

1

Mr. Gary Guenther  
Congressional Research Services  
101 Independence Avenue S. E.  
Washington, DC 20559

1

Mr. Robert F. Hale  
Congressional Budget Office  
U. S. Congress  
Washington, DC 20515

1

Dist-2



U. S. Department of Commerce  
Bureau of Economic Analysis  
1401 K Street N. W.  
Washington, DC 20230

ATTN: Mr. Hugh Knox  
Mr. Joseph V. Cartwright

1  
1  
1

Ms. Vickie Kovski  
Illinois Department of Commerce  
160 N. LaSalle Street  
Chicago, IL 60601

Mr. Ronald Kutscher  
Assistant Commissioner  
Bureau of Labor Statistics  
601 B Street, S. W.  
Washington, DC 20212

1

Dr. John Morgan  
U. S. Bureau of Mines - MS 1003  
2401 E. STREET, N. W.  
Washington, DC 20241

1

Mr. William Taylor  
Office of Senator Bill Bradley  
U. S. Senate  
Washington, DC 20510

1

Mr. Bill Warren  
Small Business Administration  
1441 L Street N. W.  
Washington, DC 20416

1

#### CIVILIAN AGENCIES

Mr. Roderick Alderton  
General Electric Company  
777 14th Street N. W.  
Washington, DC 20005

1

Mr. Thomas G. Augherton  
Republic Steel Corporation  
# 703  
1101 15th Street, N. W.  
Washington, DC 20005

1

Mr. Gregory Barthold  
Aluminum Corporation of America  
Washington Sales Office  
1200 18th Street, N. W.  
Washington, DC 20036

1

Dr. Douglas Brown  
Department of Economics  
Georgetown University  
Washington, DC 20057

1

Dist-3

Data Resources Inc.  
1750 K Street N. W.  
Washington, DC 20006

ATTN: Dr. George Brown  
Dr. Lawrence R. Forest

Mr. George V. B. Day  
The Aluminum Association  
818 Connecticut Avenue, N. W.  
Washington, DC 20020

Ms. Virginia C. Lopez  
Aerospace Industries Association  
1725 DeSales Street, N. W.  
Washington, DC 20036

Dr. Karen Polenske  
Building 9 Room 535  
Massachusetts Institute of Technology  
Cambridge, MA 02139

Dr. George R. Schink  
Wharton Economic Forecasting Associates  
3624 Science Center  
Philadelphia, PA 19104

Institute for Defense Analyses  
1801 N. Beauregard Street  
Alexandria, VA 22311

ATTN: Dr. William J. Schultis  
Mr. Seymour Deitchman  
Mr. Robert Pirie  
Ms Neang Ith  
Ms Meg Sheridan  
Mr. Paul Richanbach  
Miss E. Doherty  
Control and Distribution

1  
1  
1  
1  
1  
1  
1  
9

16

**END**

**FILMED**

**10-84**

**DTIC**